JUNE, 1941

FACTORY

MANAGEMENT and MAINTENANCE

A McGRAW-HILL PUBLICATION

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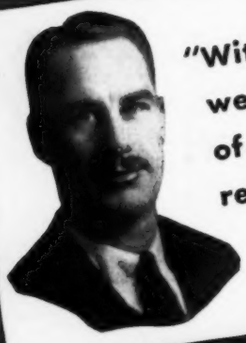
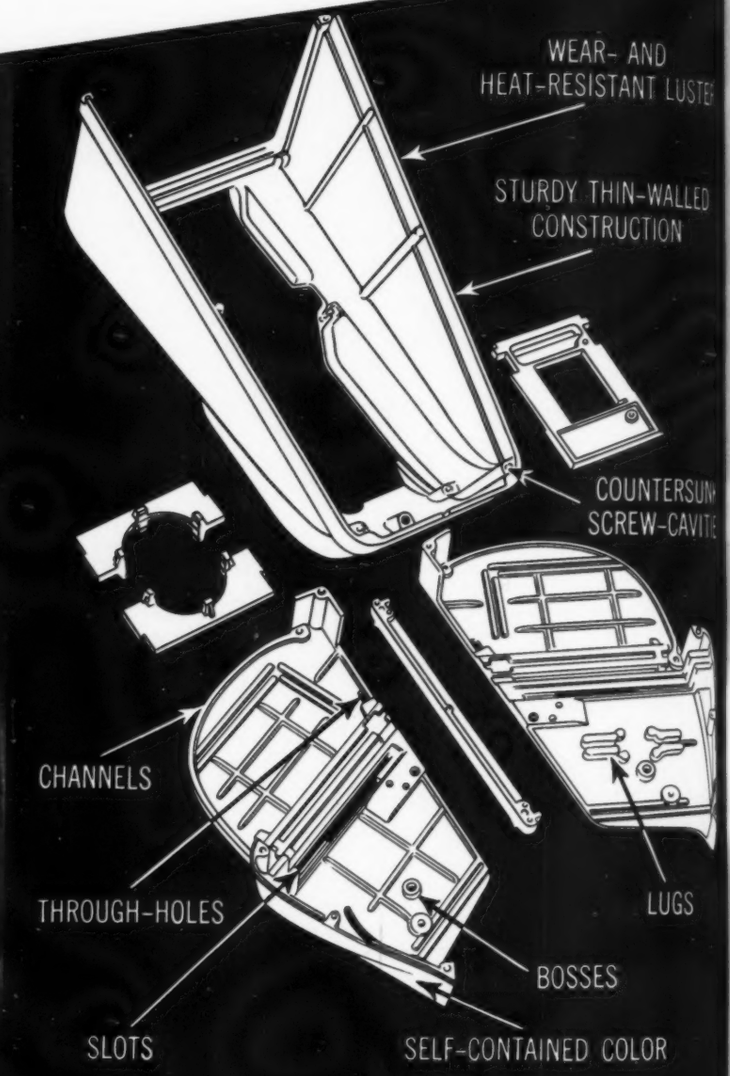


"With BAKELITE Plastic construction we were able to minimize the number of parts, simplify finishing operations, and reduce weight of our Projector-Viewer"

—W. L. CHAMBERS, Designer and Engineer, Novex Corporation



MOLDED to final dimensions in just seven sections, the 14 inch long housing for the Novex Projector-Viewer demonstrates some of the many reasons why cost-conscious manufacturers are turning more and more to BAKELITE Plastics.

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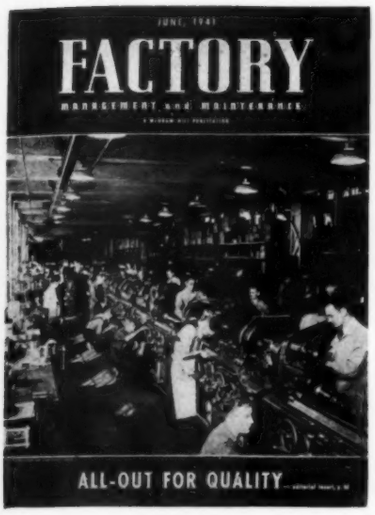

A 300 percent increase in output over the peak of 1937! This remarkable record, hung up by the Machine Division of Norton Company, Worcester, has been made possible through the application of modern mass-production methods to the manufacture of precision tools—by straight-line assembly for instance, as exemplified in the line of 6-in. cylindrical grinders shown in this month's cover, or in similar lines of 10-in. cylindrical, surface, universal, and tool grinders. Kodachrome by Norton Company photographic department.

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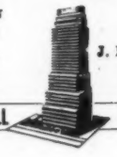

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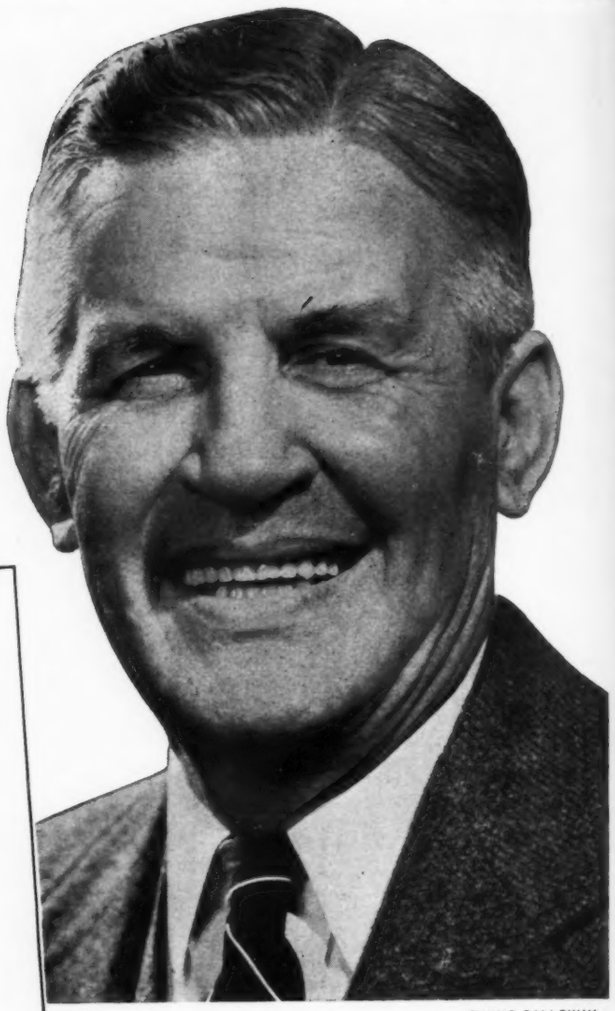

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HOW "UNLIMITED EMERGENCY" WILL AFFECT INDUSTRY

"I call upon all the loyal citizens engaged in production for defense to give precedence to the needs of the nation to the end that a system of government that makes private enterprise possible may survive. I call upon our loyal workmen as well as employers to merge their lesser differences in the larger effort to insure the survival of the only kind of government which recognizes the rights of labor or of capital."—From the President's proclamation that an unlimited emergency exists.

BLUEPRINT OF FOREIGN POLICY

The electrifying first effect of the unlimited emergency shakes down, in perspective, to a reasonably simple and not especially frightening state of affairs. The "fireside chat" definition of our foreign policy holds far more significance than the emergency declaration itself.

When he staked out our defense objectives in his chat, the President told industry in effect: "Dig in for a long period of defense production. It is now a certainty that this job will last for years." When he issued his proclamation of unlimited emergency, he merely took a necessary step toward the complete economic mobilization which may *eventually* be forced upon us.

WAR MAY NEVER BE DECLARED

War may come, but it may never be declared. M-Day may come, but it may steal upon us unawares. Historians may look back and find that there was no single day on which it could be said: "Yesterday we were not at war, yesterday we still had a peacetime economy—today we are at war, today industry is wholly mobilized for war alone."

Going back three years to FACTORY's first "War Communiqué," we find that the once-awesome term, "unlimited emergency," has acquired a new and more moderate meaning. At that time it was fraught with the promise of dire and, to industry, unaccustomed things such as priorities, price control, plant commandeering, the conscription of labor and of management, the nationalization of war manufactures, and government operation of the railroads, utilities, and communications.

WAR ECONOMY MAY LAST FOR YEARS

The able authors of the Industrial Mobilization Plan envisioned war as a sudden thing. Just so, we thought of M-Day as a swift, explosive transformation. Now we see the complete war economy as the possible result of a long evolutionary process.

In June, 1940, FACTORY described some 100 industrial control laws which would be called into play by declaration of an unlimited emergency. Since then a "limited emergency" has been operative, and a goodly proportion of these controls have already been put—partially—into effect. We have dipped our toes in priorities and price control. We have had, for eight months, a law authorizing the seizure of plants when and if their owners reject government contracts.

Of M-Day's original major measures, then, what have we yet to experience or contemplate? The answer is: Only the government

control and operation of transportation, utilities, and communications, and certain measures affecting individual as well as industrial liberties, such as the conscription of management. Rigid governmental control seems unlikely unless industry has a major fall-down in production. However, there may be hidden significance in the new RFC bill which would let the federal government compete with industry in almost any field.

MORE INTENSIVE CONTROLS

Thus the unlimited emergency simply sweeps away the legal obstacles to more intensive use of existing controls. It clears the way for tighter and better coordinated priorities, it authorizes wider and more effective price controls. It may even be employed for the regulation of labor relations. But it does not necessarily imply an overnight leap into totalitarianism.

The continuance of our economy on a private enterprise basis owes everything to the fact that industry has supported the defense program so wholeheartedly. It has not been necessary for the government to commandeer a single plant because *no* manufacturer has refused to produce for defense. The machine tool and aircraft industries are cheerfully doing the impossible every day. The electrical goods and automotive industries and scores of others have shown neither reluctance nor incompetence to produce. There has been no profiteering. And management has met labor a great deal more than half way.

INDUSTRY STANDS ACE-HIGH

"Upon the ability of industry and government to cooperate effectively in the current crisis may depend the whole course of government-industry relations in a major war effort," FACTORY pointed out just a year ago this month. Today it may be said that industry *has* cooperated and its standing with the public has never been higher.

The story could have been much different. Without such cooperation the government, using only the powers of a limited emergency, could have made deep, serious, and permanent inroads in the domain of private enterprise.

Let us consider now the principal new governmental powers made available by the unlimited emergency. Do the railroads require public operation? To date they have met every demand smoothly and efficiently. Do we need mandatory priorities? Yes, but only because they will clarify the problem, not because industry has refused to try them on a voluntary basis. This has been true, likewise, of price controls. Will is be necessary to conscript industrial management? A look at the roster of the OPM answers this.

WILL A CRACK-DOWN COME?

In only two fields—the public utilities and labor relations—does it seem likely that the new emergency powers may be employed for a governmental crack-down. Significant indeed is the warning by T. R. Tate of the Federal Power Commission of a national power emergency. Mr. Tate warns that restriction of civilian use of power may become necessary. Industry, even non-defense industry, would be the last to face restriction.

In labor relations the President now has the power, if he has the determination, to put a virtual stop to all but a tiny minority of defense strikes. This does not mean that he will take over struck plants and call out the Army to help him run them. There is still serious legal question of his right to commandeer *any* plant, even in an emergency, unless the management has refused to accept government contracts. But he *can* set up a czar over labor with enough power to make recalcitrant labor leaders uncomfortable.

Either by decree or by law, mediation could be made compulsory. The National Defense Mediation Board could be made paramount. Then, every dispute, after a long "cooling off" period, would be referred to it for public judgment.

CONCLUSION

The presidential declaration of an unlimited emergency would have been, six months ago, an impressively significant event. Today it serves chiefly to snap up the nation psychologically, to take the headlines off the convoy question, and to provide the government with potentially greater power over industry than it will need or use. It is well to remember that an unlimited emergency can be proclaimed only in time of "war or the imminence of war." This re-defines our position in world affairs and warns us that we may some day attain a complete war footing although we may be years in the transition.

FACTORY
MANAGEMENT and MAINTENANCE
L. C. MORROW, Editor

Government Could Stop Defense Strikes

IF ONLY THE DEFENSE INDUSTRIES could let go the labor bear's tail they now hold and devote all their energies to increasing production!

In its emergency, the nation badly needs steel, airplanes, ships. But the steel, plane, and shipbuilding industries are afflicted by strikes. In other defense industries the same situation prevails.

Labor Department records show 3,025,000 man-days lost by strikes in all occupations during the first three months of 1941. In the corresponding period of 1940 the figure was 921,000. Here is an increase of considerably more than 200 percent.

A National Association of Manufacturers survey shows approximately the same total (3,023,000) man-days lost, and divides this figure into 1,578,000 lost by defense industries against 1,445,000 by non-defense industries. Obviously, obligations that would seem to be inherent in defense contracts do not induce restraint on the part of labor leaders.

Ever since the defense program began, labor's earnings have increased rapidly while living costs have advanced only slightly. In the great majority of its strikes labor has asked for increases that could not be justified on the basis of increased cost of living. And it has attempted to bring about complete unionization in specific plants or industries by trying to force employers to require all employees to join the union.

Even the most patient citizens, and those most sympathetic toward increased gains for labor, must now be convinced that something needs to be done. And the remedy is in the hands of the government. A complete remedy could not be used, because it would require so many changes that confusion would result. But a partial and, I believe, fairly effective remedy could be applied. Suppose these things were to be done:

1. Congress enacted a law providing for a cooling-off or waiting period, during which mediation was carried on.

2. Congress and the states enacted laws denying strikers the right to keep away from work the employees who did not want to strike.

3. The National Defense Mediation Board was permitted to intervene instead of waiting for certification of disputes by the Secretary of Labor.

4. A more realistic, less idealistic person was substituted for the present Secretary of Labor.

I think that, if those things were done, and if the Wage-Hour and Walsh-Healey Acts were suspended in order to bring about lower defense costs, the nation could afford to wait for the other changes that should be made in labor legislation. At any rate, the procedures proposed would tend strongly toward bringing about conditions under which labor relations could be carried on in accordance with the ideal expressed during the World War by a committee of representatives of employers and labor, headed by Samuel Gompers, then president of the American Federation of Labor.

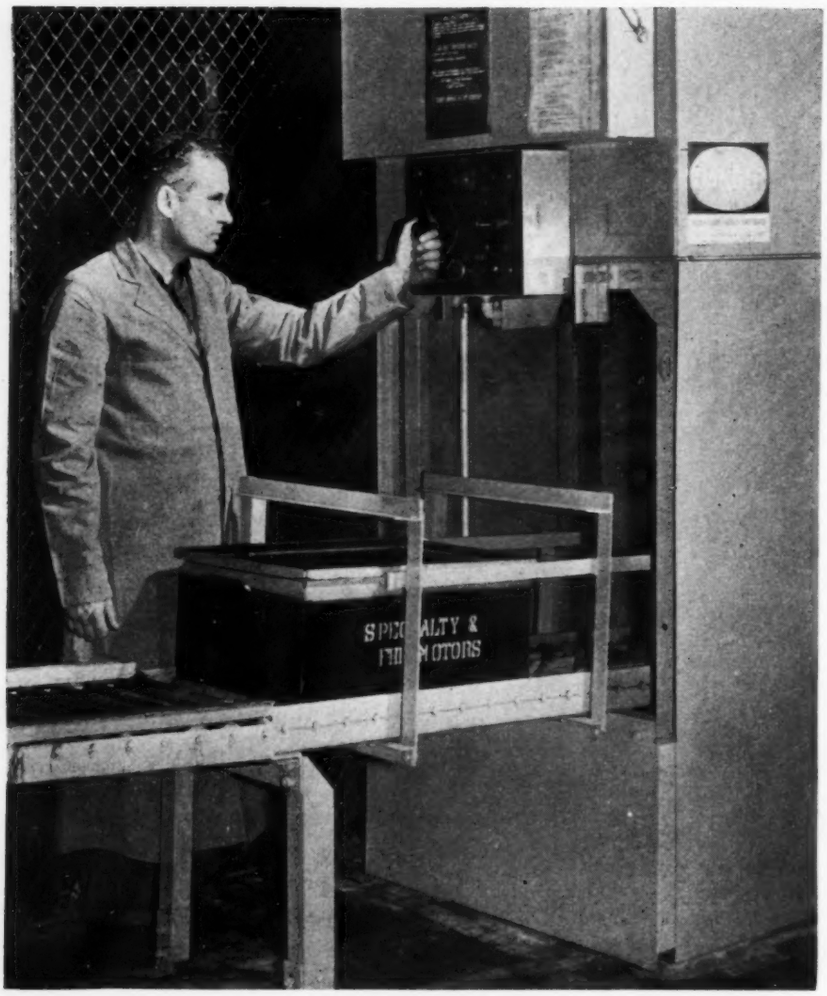
This committee recommended that the Council of National Defense should urge adherence to these policies: "Employers and employees in private industries should not attempt to take advantage of the existing abnormal conditions to change the standards which they were unable to change under normal conditions. No arbitrary change in wages should be sought at this time by either employers or employees through the process of strikes or lockouts without at least giving the established agencies, including those of the several states and of the government . . . an opportunity to adjust the difficulties without a stoppage of work occurring."

L. C. Morrow

Delivers the Goods Automatically to Fifteen Working Floors

No traffic jams. No waits for transportation. Overhead conveyor system assures steady flow of materials, parts, and finished product. Any operator at any one of 36 sending stations may dispatch a load to any one of 49 receiving stations on any one of the three loops

F. M. METRAILER
General Electric Company, Fort Wayne Works



One of 36 loading stations on overhead conveyor system that serves fifteen floors in four multi-story buildings at Fort Wayne Works of General Electric Company. Tote boxes are loaded automatically, routed automatically to any station on the system

QUICK, ACCURATE, AND AUTOMATIC transportation of raw materials, work in process, and finished goods among the departments of four of our major buildings became essential a few years ago. These are multi-story buildings, using a total of fifteen working floors for departments of the fractional-horsepower-motor division.

We were moving our materials with hand-push box-type trucks and flat-top platform trucks, and with power lift trucks using skid boxes and skid platforms. Travel between floors was on freight elevators.

As production requirements increased, congestion of traffic and of floor space built up almost imperceptibly through the years. This reflected itself in factory aisles obstructed with platforms and boxes, although the aisles were wide enough to accommodate the variety of vehicles. Many machine tools were surrounded with work in process, with finished parts awaiting removal, and with scrap accumulated from machine operations. Truckers sometimes had considerable waits to pass a traffic jam, or to get aboard elevators with their loads. Stock shelves in the assembly departments were filled to capacity, because steady operation of assembly lines had to be assured by carrying large inventories of parts lest the flow from contributing departments be held back. At strategic points throughout the plant were accumulation depots, where materials had to be rehandled manually.

Not a Sudden Condition

Because this was not a sudden condition, we had learned how to live with it —though, as we look back, it seems surprising that we were able to do so. Eventually we faced so many increments of added production costs, and so many bits of time lost toward the delivery dates which are an important sales consideration in getting and holding business, that it was decided the difficulties must be overcome by a completely mechanical equipment of some kind. Our internal transportation required organizing so that work and material in all stages would reach the proper place at the proper time, and in economical quantities.

Transfer station is reached by all three conveyors. If a tote box is headed for another station on another loop, one of the operators sends it on its way. If for storage, it goes on a roller conveyor to be moved to its proper position in the surrounding stockroom

Listing our requirements disclosed something like the following "musts":

1. *Must* release for manufacturing purposes 15,000 square feet occupied by platforms and boxes.

2. *Must* be a permanent installation which could be made to fit into any probable factory layout with a minimum of down-time and expense.

3. *Must* be installable while the factory continued operating, with a minimum interference to production during installation.

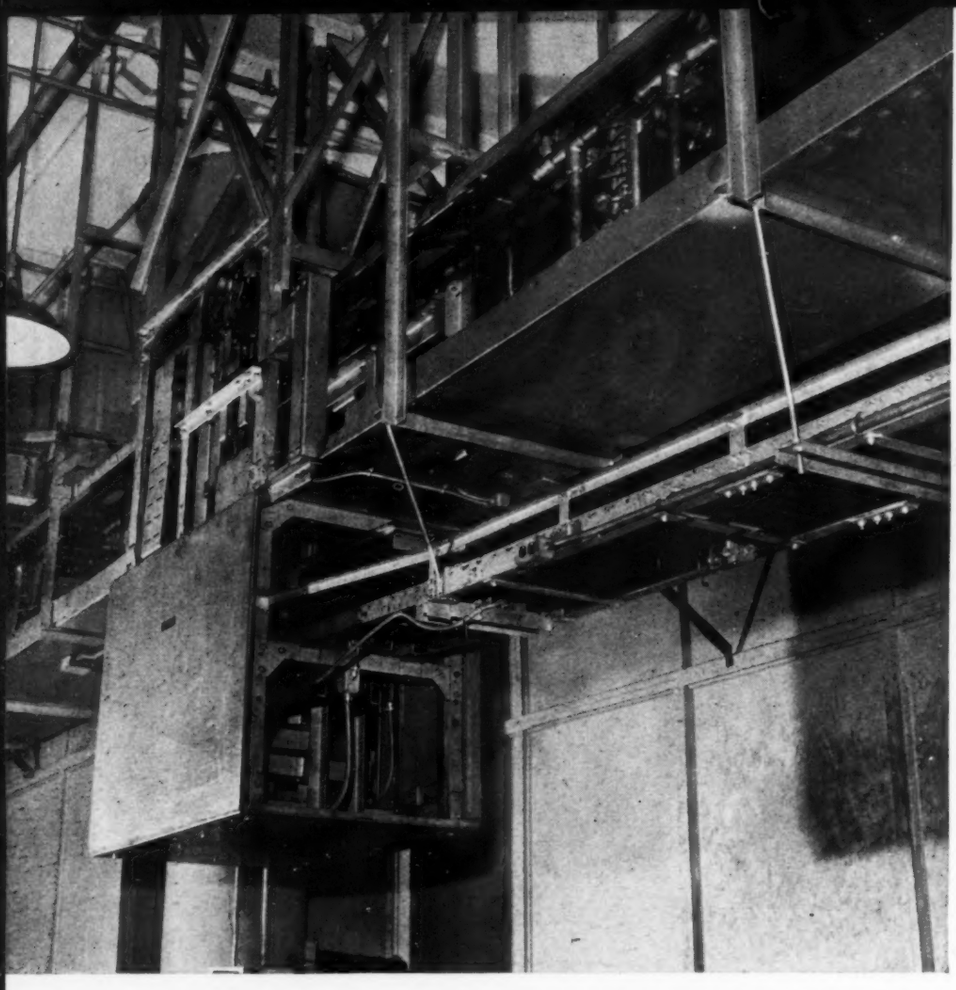
4. *Must* operate continuously at low power and maintenance cost.

5. *Must* accommodate the three sizes of stacking boxes, all having one dimension of 17 inches, which were already in use and fitted to the stock shelving.

After exhaustive investigation and an amount of intensive collaboration with the manufacturers of mechanical handling equipment, a system was selected which is basically a chain-and-trolley equipment, riding a 4-in. I-beam and supporting a carrier big enough to handle the three sizes of stacking boxes. The most unusual feature of the equipment is that the carriers are equipped with tab mechanisms which direct the loads to the unloading stations for which they are intended.

These tabs are set, not by hand, but by a dial on a panelboard at each loading station. Thus, when a box of parts (or anything else) is ready for dispatch to the next point where it will be required in manufacture, the machine operator, or whoever is on duty at the sending point, puts it in the loading station, operates his panelboard by a few simple motions, and the box is automatically loaded onto the next vacant carrier that comes along, is routed automatically to the point to which he directed it, and automatically unloads at that point at convenient working level ready for use.

The system consists of three separate loops, respectively 2,800 feet, 4,880 feet, and 2,304 feet, each laid out to reach and tie together the departments most closely related. The layout is also designed to reach these departments in the order of flow of work in process, thus requiring a minimum haul and a minimum elapsed time, hence a minimum of material and parts and finished goods in temporary storage while moving along the chain. For example, as the No. 1 conveyor leaves the multiple blanking department, it goes first to the repunch departments, thus disposing of the heavy load right away. In general, the major part of the load travels for only a few minutes on the chain before



Approximately 95 percent of incoming raw materials, interdepartmental parts, salvage materials, and completed products are transported on this system with a minimum of time and physical effort. Here, a tote box leaves its carrier and rolls down to work level

it reaches its destination and unloads.

A central transfer station, in the basement, is reached by all three chain systems, thus permitting interchange of loads between systems. (This transfer station is in the stockroom, hence naturally receives material from all three systems and dispatches material over all three.) But not all loads going from the region of one chain to that of another have to pass through the transfer system. For instance, one floor which is a part of the No. 2 conveyor system actually uses a considerable tonnage of blanks produced by the multiple-blanking department, which is on the No. 1 conveyor. Therefore the No. 1 conveyor makes a special loop to reach this department, for the sole purpose of carrying the blanks without any intervening necessity for handling, such as would exist if these had to be routed through the basement transfer station.

Transportation within the respective floors and between all floors is provided by a total of 36 loading stations and 49 unloading systems, spaced as required. Approximately 95 percent of incoming raw materials, interdepartmental parts, salvage materials, and completed product are transported on this system with a minimum of time and physical effort. The carriers are spaced 16 feet apart on the chain, and the chain travels 60 feet per minute. The limiting dimensions are 32 x 17 x 13 inches, and the limiting weight is 300 pounds. The system is powered with 10 motors of 7.5 horsepower each, is equipped with caterpillar drive. All drives on a system are synchronized through a variable speed transmission.

Loading and unloading stations are of vertical and reciprocating type, independently driven by ¾-hp. motors and equipped with 20-lb. brakes. Operation of the motor on a station is controlled by appropriately located limit switches which function through relays to start and stop the motor as required. The motor operates a car inside a shaft, and this car loads or unloads carriers (as the case may be) on the overhead conveyor system. Each station is equipped with safety devices and limit switches to insure successful operation of the station mechanism without interference with the overhead system, and to guard against the occasional new man who ambitiously but misguidedly undertakes to cram an oversize container or an overloaded box or a formless load into the car instead of using one of the three approved stacking box sizes and holding the loading down to 300 pounds.

Each side of a carrier has what we call tabs—although the nomenclature is likely to throw off the track anyone who has not seen them, since the word sounds more like sheet metal than like the hinged steel lugs that are on these carriers. There are six tabs on each side of the carrier. On one side, each tab represents a floor or department. On the other side, each tab represents a numbered station. Thus, when a departmental tab is turned out on its side, and a station tab is turned out on its side, the carrier is passed by all unloading stations except those in the proper department for which the carrier is thus marked, and it is passed by all stations in the department except the particular station for which it is intended.

When the carrier reaches the proper station, the unloading mechanism removes the load from the carrier, clears the tab settings, and lowers the load on a gravity conveyor at a convenient working level. The control mechanism at the unloading station consists of one limit switch on each side of the overhead system in the path of the tab mechanism. When both limit switches are closed by tabs, the motor circuit is closed through relays and operates to remove the box from the carrier and return to its normal waiting level.

Loading stations convey the boxes from gravity conveyors at convenient working levels up to the overhead carrier system, where the first empty carrier that comes along receives a waiting box. Solenoids, controlled by a dial mechanism below, operate lever arms that extend into the path of the tab mechanism on the side of the carrier as it loads, and set up combinations of tabs on the carrier, thus determining the point of unloading.

Operator Sets Dials

The dial control mechanism can best be understood by examining the illustration on page 54 along with this description. Each of the six tab operating levels on each side of the carrier is controlled by a point on a dial switch; there are two dials, one for each side of the carrier. When the steel box with its load flows into the loading station on the gravity roll conveyor, it is automatically centered in the station. Next the operator sets the dials to the required point of delivery, and pushes a button marked "Set." Now the first empty carrier passing through the sending station causes the box to be loaded into the carrier and the tab mechanism set up, as described in the paragraph just above. The panel board shown in the photograph is set to send

to Station 2 in Group 20. On one system, a spare group number is used for extra stations in departments needing more than six.

Concealed by the operator's hands in the photograph are other controls. One can be turned to either "Local" or "Remote," *Remote* is used only in a few locations where the operator's normal working position is some distance from the loading station. In such situations, a duplicate panelboard is set up on the same circuit at the working position, and by turning the button to *Remote* the operator cuts out the panelboard at the loading station.

Another button switch is "Single" or "Multiple." At some stations, the destination of successive loads varies, and here the panel is set for *Single*, which means that the Set button must be pushed for each load. At other stations, where all loads, or a series of loads, may go to a single destination, the switch is set at *Multiple*. This means that whenever a load rolls into the loading station, it travels to this identical destination without further attention; in brief, it makes the sending operation automatically repetitive.

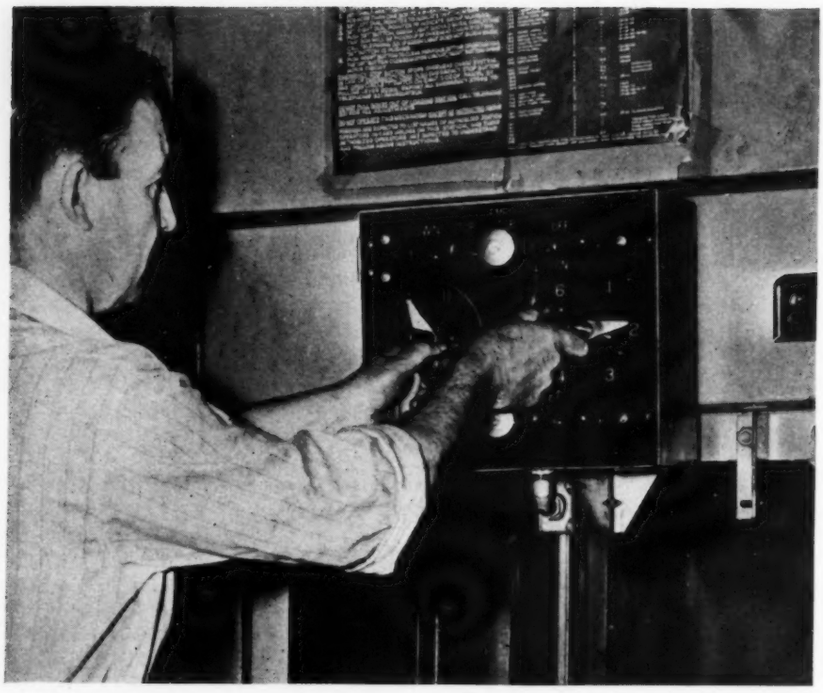
Thus any operator at any sending station may dispatch a load to any receiving station on any of the three systems. If the station of destination is on the same system as the sending station, the load goes direct. Otherwise, the dial is set so that the load goes to the transfer station in the basement. Outgoing and incoming lines are here connected by a table with its top made of roller conveyors. (Balls were originally used in this table top, but they have been replaced by rollers which seem able to withstand more battering and more dirt off the bottoms of the stacking boxes.)

When a load arrives on the transfer table, the men working there look at the production control tag accompanying the box of material. If it is for another station, on another conveyor system, an operator sends it on its way to the proper station. If it is intended for storage, the box goes on a roller conveyor to be moved to its proper position in the stockroom surrounding the transfer station. Also, if any unloading station gets out of order, the transfer station can be set to unload all boxes for this point—and these loads are temporarily trucked to destination until the unloading station can be repaired.

Similarly, if an error occurs in setting tabs, whether due to mechanical, electrical, or human error, the transfer station automatically picks up this load, and the operators here re-dispatch it to where it should go. This automatic clearance positively prevents material being lost in the system. The normal force on this transfer station consists of two young men, but if work begins piling up, they can get temporary assistance from a hoist operator and a truck operator who are always at work quite nearby.

Adjacent to the transfer station is a panelboard where telltale lights burn steadily to show that the system is working properly. Each light represents a section of conveyor, somewhat on the order of a block on a railroad. If anything goes wrong in a section, that light dims, and the maintenance man

When a carrier and its load arrive at the station to which they have been directed, the unloading mechanism removes the load from the carrier, clears the tab settings, and then lowers the load to a gravity conveyor at a convenient working level



Each of the six tabs on each side of the carrier is controlled by a point on a dial switch. There are two dials, one for each side of the carrier. The panelboard shown in this photograph has been set to send the load to Station 2 in Group 20

goes straight to this section and finds the trouble.

At this board is the only place where the chains can be started or restarted. Of course, they may be stopped by emergency buttons at every station. Incidentally, we keep a chart showing operating time and down time for the conveyor system, in terms of the efficiency ratio obtained by dividing scheduled operating time into actual operating time. This runs close to 93.7 percent now, with the plant going at capacity and therefore running the conveyor continuously on close to its maximum load. Since most of the downtime comes in very brief periods—a few minutes when a fuse blows or a switch must be replaced—and since the conveyor has carrying capacity substantially in excess of what we use, this means that there is little or no interruption of normal production ascribable to the conveyor system in a typical month. Power required to operate the system runs well below $1 an hour, and maintenance of the system, including lubrication and installation of minor improvements, runs approximately $7,000 per annum on the total investment. The system requires the use of 32,414 stacking boxes.

In the stockroom, adjacent to the transfer station, are kept all raw materials, in-process parts, and subassemblies. At one end of the transfer table is an electric hoist used to lift boxes from the floor to the conveyor level, or to lower them from the conveyor to the floor. This hoist is the link between the conveyor system, which distributes boxes throughout the fractional-horsepower-motor division and brings them to the stockroom, and high-lift fork truck that picks up the boxes, and moves them to and from storage and the conveyor at the transfer table.

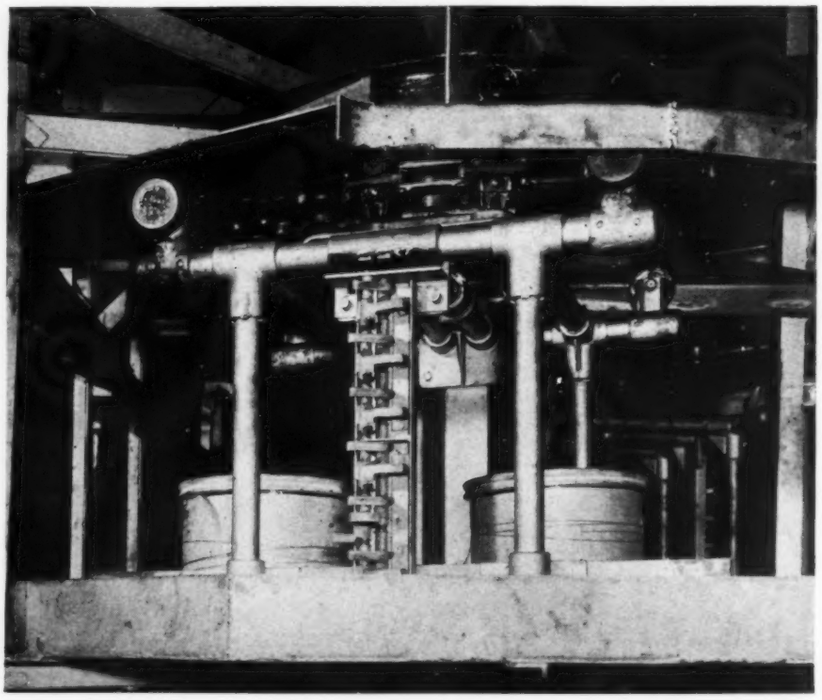
Without the high-lift fork truck, we should lose much of the advantage of this conveyor system, since it makes it possible to tier the stacking boxes to a height of 72 inches. Its narrow width —26 inches—permits narrow aisles. Optimum machine runs on various component parts may far exceed the current requirements of the assembling or reprocessing departments that use these parts. The current requirements are dispatched directly from the department that contributes them to the department that uses them. But the surplus, for future use, must be stored in the stockroom.

Economical Storage

Teaming the electric fork truck and the conveyor, with the intervention of the hoist, makes for economical storage and inexpensive rehandling at this point. The importance of this function may be indicated by the fact that before the conveyor system was installed the accumulation of finished parts around the machines immediately following their completion was considered a factor that decreased the probability of meeting delivery dates.

The entire mechanical handling sys-

(*Continued on page* 208)



There are six tabs on each side of carrier. On one side, each tab represents a floor or department; on other side, a numbered station. Thus, when a department tab and a station tab are turned out, carrier is passed by all stations except the one marked

Why Not T.B. Tests for All?

Tuberculosis can be contracted from other workers; wise precautions include a test for all — to prevent ill health and to reduce the chance of lawsuits

Only 12 people, less than ½ of 1 percent, had active tuberculosis germs when 3,300 of Thompson Products Company's 4,000 employees voluntarily took tests

In the Ohio courts, a worker who was forced to quit work because he was suffering from tuberculosis, recently brought suit against his former employer, claiming that he had contracted the disease from a fellow-worker in the plant. The defending employer won the case, but the incident caused considerable discussion among employers, and it may result in the general practice of testing applicants by fluoroscope for lung and chest disorders as part of the hiring procedure.

Tuberculosis is not a "compensable" disease in Ohio—that is, a worker who contracts the disease cannot claim workmen's compensation, as he can for an accident, or for damages on account of a recognized occupational hazard.

Contracted From Others

Medical experts, however, declare that most persons who suffer from tuberculosis contracted it from someone else. It is seldom caused by working conditions, except in certain specific instances where abnormal temperature, moisture, or dust conditions prevail. Inasmuch as workers can and do contract the disease from other workers, there is a possibility that some court may hand down a decision that management is responsible for the damage because it employs tubercular workers.

The Anti-Tuberculosis League of Cleveland and Cuyahoga County, Ohio, recently tested 3,300 of the 4,000 Thompson Products' Cleveland employees with fluoroscope and X-ray, for chest and heart ailments.

The management of the company first took up the matter with representatives of the employees. These men voluntarily took the test themselves. Then, with the cooperation of plant foremen, they solicited the entire personnel for voluntary submission to the examination. Only 900 declined, and several theories were advanced for their reluctance. One was the "ostrich complex" which actuates so many people—the feeling that if they have a serious disease, or are threatened with it, they would rather not know about it.

Although the management took a keen interest in the tests from a general welfare angle and from humanitarian motives, it did not interfere in the program at all. The League drove its mobile trailer unit, which serves as a clinic, right into the factory, and employees went to the clinic in groups. Tests were made during regular working hours, employees lost no pay, and the average time spent by each worker in taking the examination was 10 minutes; 2 minutes to walk to the clinic; 2 minutes waiting time; 3 minutes in the clinic; and 2 minutes to walk back to the job. The physicians tested three persons at a time, or 50 an hour. In 61 hours of actual working time, the entire 3,300 examinations were completed.

A summary of the results showed that less than 3 percent of the employees might be affected. An X-ray examination of suspected cases proved that only 12 persons, or less than ½ of 1 percent of the total, had active tuberculosis germs. These persons were reported to

(*Continued on page 164*)

Telling the World—and the Workers

American Optical Company tells all in the local papers—by a series of institutional advertisements that keep townfolk and workers aware of what goes on in the plant

MORE THAN five years ago American Optical Company of Southbridge, Mass., manufacturers of ophthalmic and industrial safety equipment, conceived a unique advertising campaign with the idea of acquainting its employees with operations performed all over the plant. The medium for this educational work was to be the local press.

It was felt that the employees would be interested in what their fellow-workers were doing and that informational advertisements could accomplish this objective very nicely. At the same time the messages would tell the people of Southbridge something about the broad range of activities carried on by their neighbors at AO.

The employees and their jobs are the real theme of the advertisements, as you will note from the one reproduced on this page. The workers are photographed while actually at work, and the copy stresses their jobs and skilled craftsmanship. Padding this phase of the copy is not necessary, because many of the company's manufacturing processes require exceptional care and skill.

It is interesting to note that the employees relish being photographed and having their jobs written up. A print of the picture is always presented to them in appreciation of their cooperation, a gesture which pleases them immensely. As a matter of fact, they would be very disappointed if they didn't receive their pictures.

The town of Southbridge is likewise stressed in the copy. Many of the town folk work for the company, and accordingly there is a close connection between the community and the concern. Each is dependent on the other, hence the fitting slogan that Southbridge and American Optical Company are synonymous in the production of fine quality spectacles, eye-examining instruments, and safety goggles.

If at all possible, the advertisements are tied in with current news. The optical concern makes essential national defense material, and this fact permits the featuring of workers engaged in manufacturing such products as aviation goggles, diagnostic sets, and eye-testing instruments for examining the vision of Uncle Sam's new army. In other words, a definite attempt is made to take real news pictures and to write timely, interesting, newsy copy.

In addition, new developments, when they are announced, are generally used for copy. This frequently necessitates taking pictures in the company's research and development laboratories. Such pictures present an opportunity to stress the essential work accomplished by the research technicians who also belong to the company's great family of nearly 5,000 employees in the Southbridge factories alone.

Aside from the prestige angle, the advertisements provide a steady revenue for the two Southbridge papers in which they appear. One of the papers is a weekly and the other a daily, and because Southbridge is a small town—its population is approximately 16,000—the circulation of both papers is limited. However, the two papers can depend on this definite income, because the messages are scheduled to continue indefinitely.

In short, it is believed the advertisements help to build a friendly feeling between company, employees, community, and press—a good reason for their continuance.

Down at the AO

Protecting the Vision of National Defenders

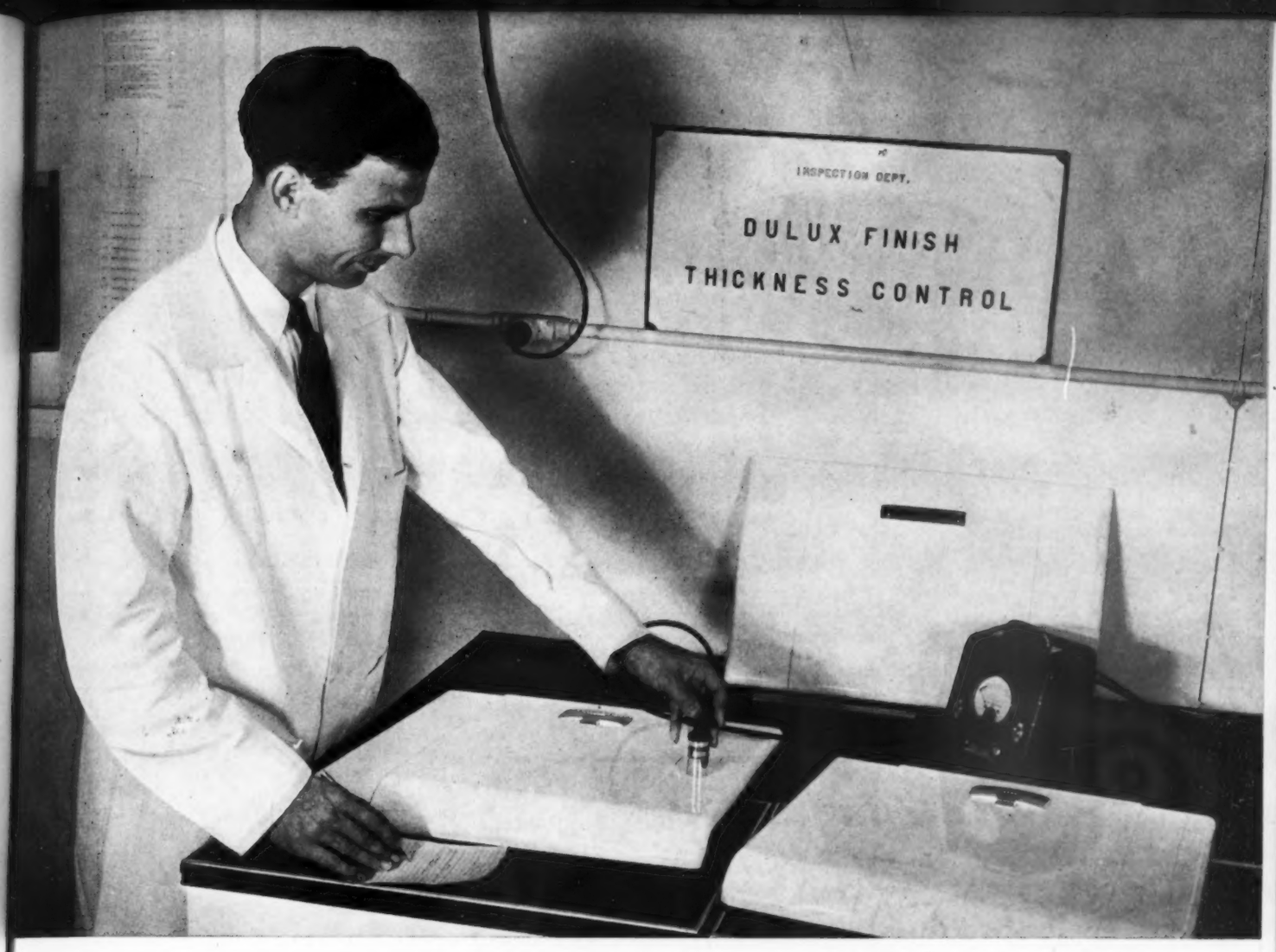
GOOD VISION is one of the prime requisites of the airmen of our country's armed forces, and protection of that sight is vitally important. So, as part of the national defense program and to guard the "eyes" of the Army and Navy—the air corps—AO folk are working at top speed to equip thousands of fliers with fine goggles—goggles by American for Americans.

It was to Southbridge that our army men looked for help in protecting the vision of our birdmen. And wasn't this natural, in as much as Southbridge has the world-wide reputation of being the home of master craftsmen and highest quality ophthalmic products?

In the picture are some of the AO people engaged in supplying these eye needs in national defense. All of them are busy on one phase of goggle assembly—soldering the light metal eyepieces. Left to right, John Nuckle, Rosario Ravenelle, Gerard Lapointe, Girard Geroux, Joseph Lavallee.

No. 246 AO *in a Series*

AMERICAN OPTICAL COMPANY



Samples of production pieces are tested daily for thickness of finish, acid resistance, impact, adhesion, and scratch hardness

All-Out for Quality

R. F. BISBEE, *Manager of Quality Control, Westinghouse Electric & Manufacturing Co., Mansfield, Ohio*

QUALITY IN A PRODUCT isn't there because of any accident: it is built into a product in only one way—by exercising diligent control that extends into suppliers' plants even before raw materials reach the unloading docks, follows every step of the manufacturing process, and continues through the warehouse and freight car and delivery truck into the home of the ultimate user.

In the Mansfield plant, therefore, where we build refrigerators, ranges, irons, water heaters, and other electrical appliances, our management believes in maintaining a scientific quality control system. Our personnel is highly trained. Our control laboratories are equipped with the finest modern instruments.

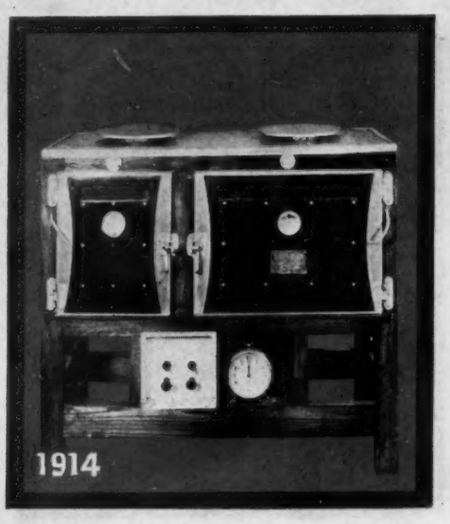
The name of our department has been changed from "Inspection" to "Quality Control" because in our minds the definition of the word "inspection" in a manufacturing plant is "control of quality, working as the customer's representative and the management's guardian of every product manufactured." Improved quality at a competitive cost is the best weapon that we can give our sales department to increase sales and profits. To accomplish this basic objective:

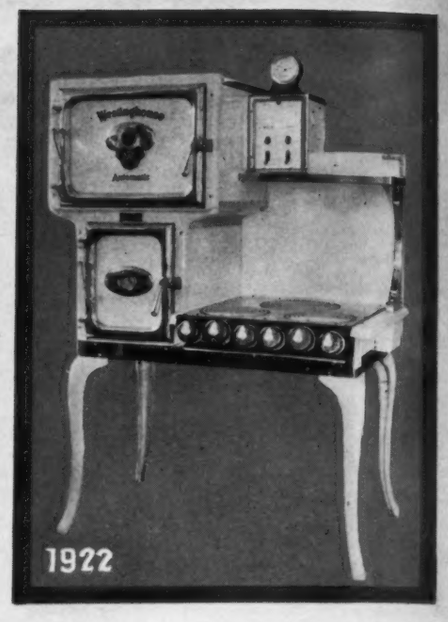
Inspection should always work as a prevention rather than as a cure. Finding and stopping defects before additional operations are performed, results not only in improved quality, but also in reduced cost—both manufacturing cost and cost to the user.

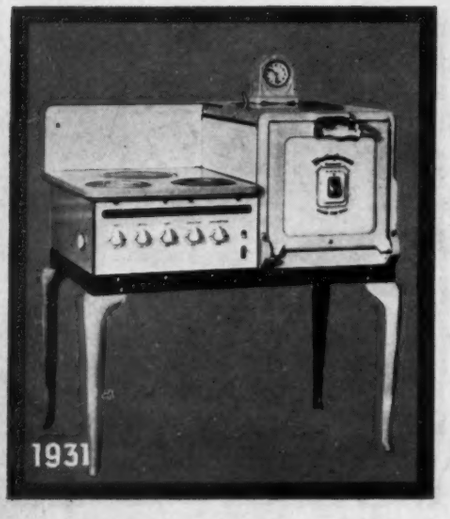
Our department is staffed by 230 highly trained engineers and skilled workers. It is equipped with checking and testing instruments valued at $300,000. Some 3,000 precision instruments are in constant use. Many of them are checked against master instruments as often as every eight hours to insure accuracy.

A total of 6,000 individual checks and tests are made by the department on the parts of one product alone—the electric range. CONTINUED ON NEXT PAGE

ALL-OUT FOR QUALITY







Let's Pick a Product and Look at the Record

HOW CLOSELY THE STORY OF QUALITY is woven into the product! The range Westinghouse brought out in 1914 looked like a combination icebox and incubator with a clock to show when the chickens were due to hatch. It was hailed as a masterpiece of engineering, beauty, and styling. Ovens were aluminum. Frame was walnut.

Wood soon disappeared. The 1917 range had a frame of steel and cast iron. Porcelain enamel also made its bow. A year later Westinghouse moved its range plant from Flint, Mich., to Mansfield. That plant in April of 1918 had 200 employees and approximately 100,000 square feet of manufacturing floor space; today it has more than 5,000 employees and upwards of 1,200,000 square feet of space.

In 1922 came the vitreous enameled oven, and three years later the first all-enamel range was introduced, bringing in its train the headaches caused by the materials and processes then available. Cost of enameled parts was high, chippage was excessive.

By 1931 the use of enameled parts had been expanded, and colors had come into the picture. The buffet range of 1932 represented a radical change in styling. The chippage problem had become even more acute; as many as 18 percent of these ranges were found to be chipped when received in the field.

Range designers rounded the corners in 1933. The "streamlined" kitchen began to appear in 1936. And the 1941 range illustrates the tremendous improvement in over-all design that has been made over the years. Industry sales have grown from 50,000 in 1932 to more than 400,000 in 1940. A comparable model that sold for $208 in 1932 costs $99.50 today.

Thus we see how quality has been built into the product —and how constant improvement of the product has intensified the problem of quality control and led to the development of new techniques of control. In the pages that follow we shall highspot those techniques—and learn how, for example, enamel shop losses have been cut to less than one-tenth of the old figure, how chippage has been reduced to less than 1 percent.

Control Begins Before Materials Come In

QUALITY CONTROL starts even before raw materials enter the plant. The first step is to be sure suppliers know and can meet standards. The control system begins to function in high gear when raw materials arrive at the receiving docks.

Tests made at this point may be broken down as follows:

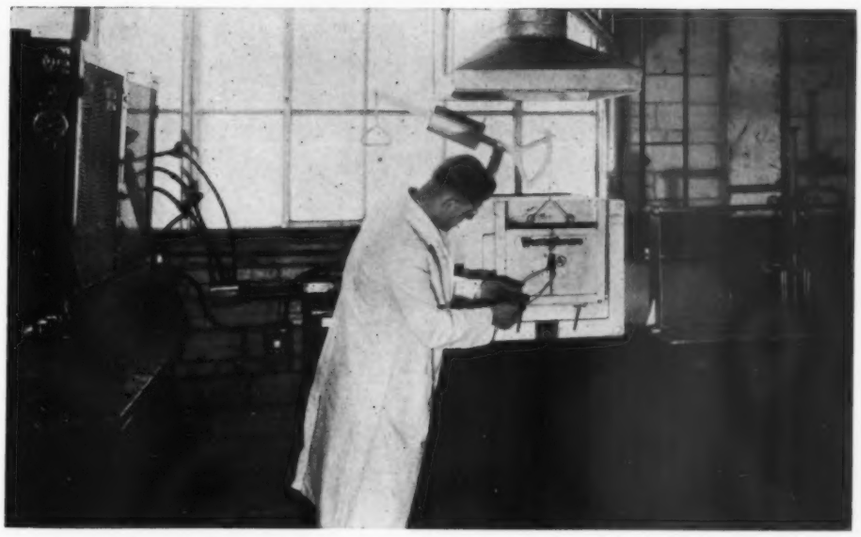
1. *Sampling* — when electrical, thermal, or physical requirements are exacting, samples are sent to the manufacturing control laboratories and checked before the shipment is released to stock.

2. *Spot checking*—for materials that have to be checked for mechanical dimensions or finish only.

3. *100 percent detailing*—for materials with strict requirements where no chances can be taken.

On hardware, like nuts, screws, and bolts, spot checks are made. If 4 percent of the parts examined are found to be defective, the shipment is rejected. Samples of every shipment of stainless or monel hardware are given the acid test in the laboratory.

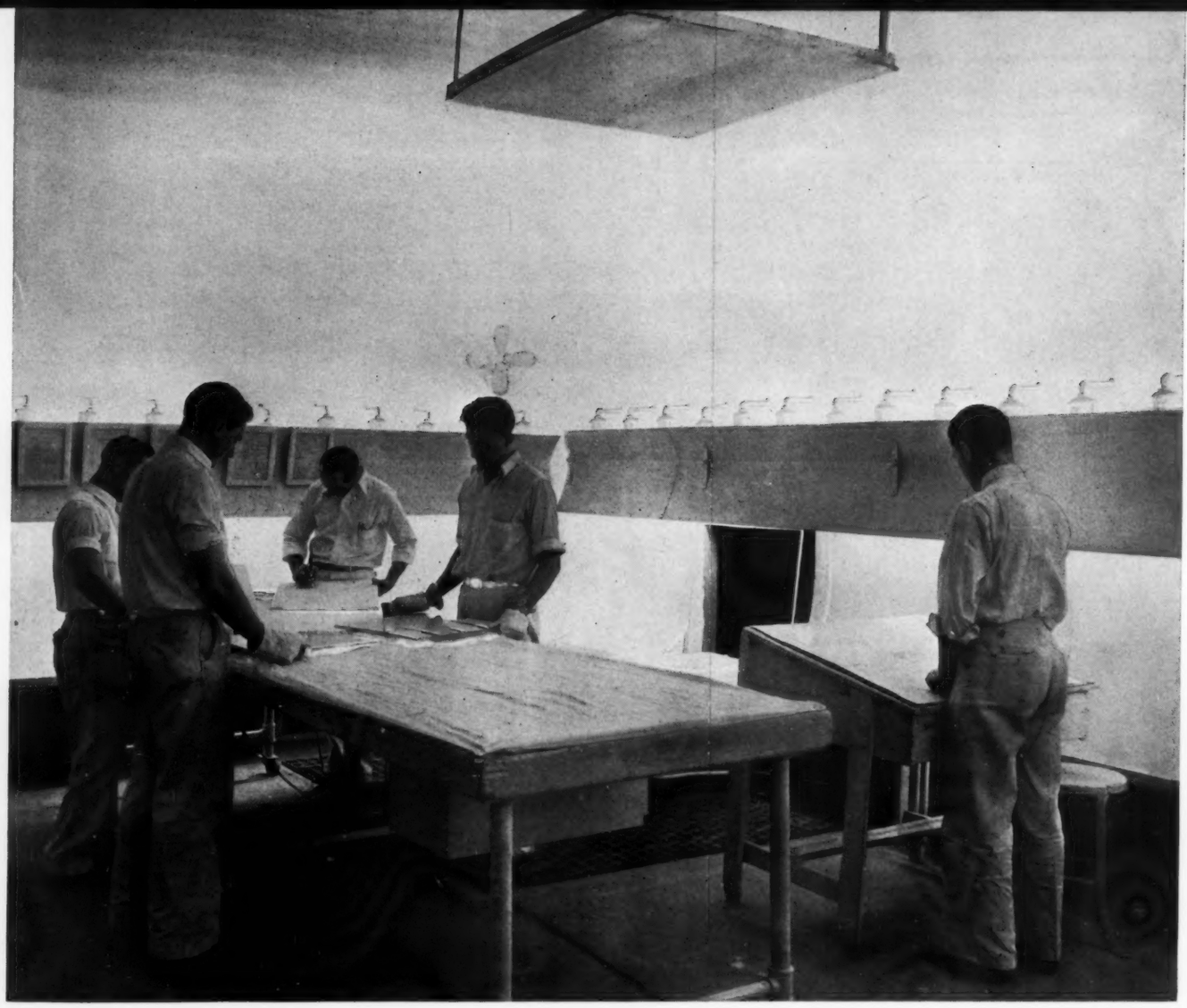
Elaborate tests are made on all types of steel used. Some idea of their importance is gained from the fact that in 1940 we received more than 70,000,000 pounds of steel. Cup tests are used to show ductility and nature of grain hardness. Rockwell tests are made to determine hardness. Other tests determine ductility, proper drawing, finish, and (of course) physical dimensions.



EACH SHIPMENT OF RESISTANCE WIRE and ribbon is checked to obtain ohms-per-foot resistance. Sample switches get a test equivalent to more than 20 years in service

INSPECTORS AT STRATEGIC POINTS only is Westinghouse rule. First is in punch shop where an inspector with toolmaker's training checks first and last pieces

SAMPLES ARE SENT TO THE LAB and checked before certain materials are released to stock. Idea is to prevent the waste of time and money involved when materials are passed as satisfactory and placed in production, and later found to be defective



INSPECTION OF ENAMEL WARE requires a close check of each piece before it is released to assembly. Ideal lighting obtains in the "Tunnel of Light" where tests are made for: (1) Quality of finish based on commercial standards; (2) thickness of enamel—pieces exceeding maximum limit are scrapped; (3) color—pieces are matched and stamped with a color number

"Tunnel of Light" and Vitamin A Therapy Cut Rejects to 3/10 of 1 Percent

COLOR MATCHING has been a problem these 15 years. Westinghouse first used the reflectometer and photoelectric color matcher. But these instruments checked the *shade* of the color, not the color itself.

Next step was to improve lighting in inspection areas. A mercury-vapor indirect lighting system, developed by company engineers and completed in 1935, produces light intensity of 200 foot-candles in the center of the room.

Color matching is simple. There are three classifications: (1) White "on the blue side"—the darkest shade; (2) medium white; (3) white "on the yellow side."

The color number is stamped on pieces as they are typed for color in the "Tunnel of Light." Pieces are sent to stock, and on the final assembly line pieces of the same number are matched and used on the same range.

The afore-mentioned improvements in lighting cut assembly-line rejects from an average of a little over 3 percent to 1.7 percent.

Good. But not good enough. It was evident that the personal equation played a major part in the problem. A study was therefore started which has led to bio-photometer tests and the use of vitamin A therapy.

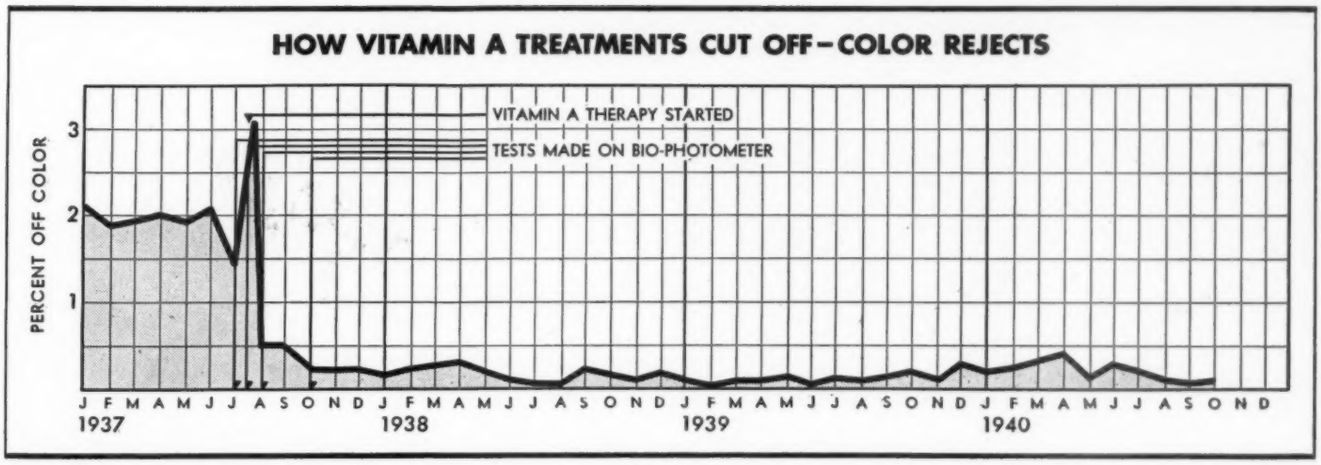
The bio-photometer is an instrument that measures the rate of regeneration of visual purple, the substance in the retina of the eye that is vital to the process of seeing.

Tests conducted among the color-matchers showed that 40 percent were deficient in visual purple, and they were brought up to "optimum" or above-normal level by vitamin A therapy. A balanced diet of foods containing sufficient vitamin A will effect the same results, but for those who preferred not to adopt such a diet, 30,000 units of vitamin A (USP) were administered daily.

Results have been astonishing. Over a 36-month period, rejects on the assembly line have been reduced from an average of 1.7 to an average of only 3/10 of 1 percent!

Benefits are threefold. Quality of product has been improved; customer complaints of off-color parts have been eliminated. A tangible saving has been made—more than $5,000 a year on ranges alone. All this, we feel, is sound economy because it helps to bring about a better product for less money. Moreover, health of workers has improved; many report they are no longer bothered by headaches, eye fatigue, and night driving.

HOW VITAMIN A TREATMENTS CUT OFF-COLOR REJECTS


PERCENT OFF COLOR
3
2
1
VITAMIN A THERAPY STARTED
TESTS MADE ON BIO-PHOTOMETER
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1937
1938
1939
1940

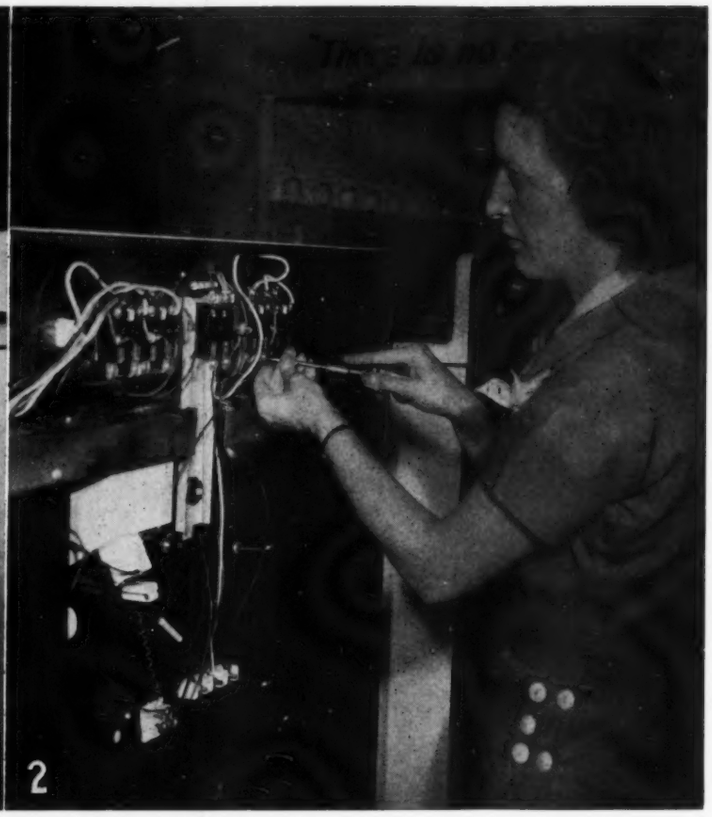
BIO-PHOTOMETER TESTS TO DETERMINE RETINAL FATIGUE proved that 40 percent of the color matchers were deficient in vitamin A. Deficiency was made good by administering 30,000 units of vitamin A daily. For results, see chart above

CONTINUED ON NEXT PAGE

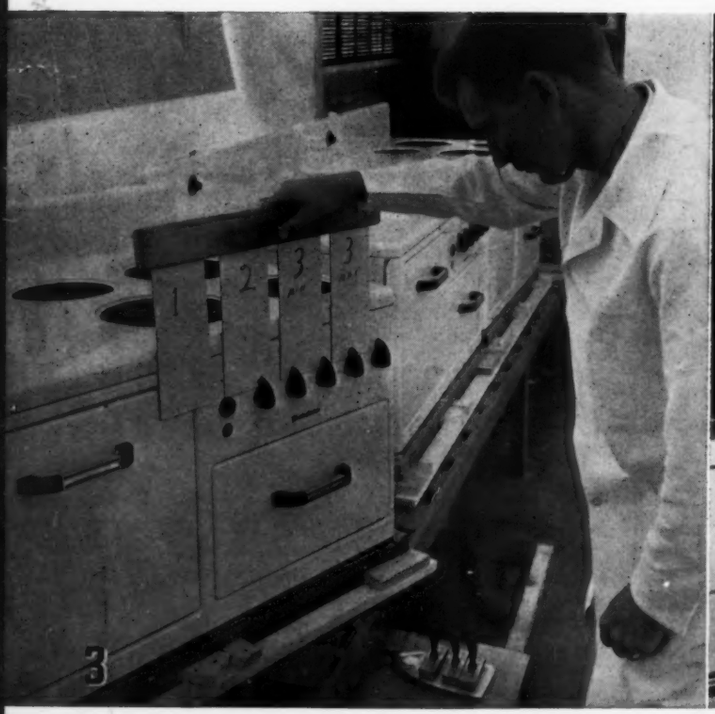
ALL-OUT FOR QUALITY

Quality Is Checked at Seven Points in Final Assembly

TAKES JUST 90 MINUTES to assemble an electric range complete, including crating. Point No. 1 on the final assembly line calls for an over-all mechanical inspection

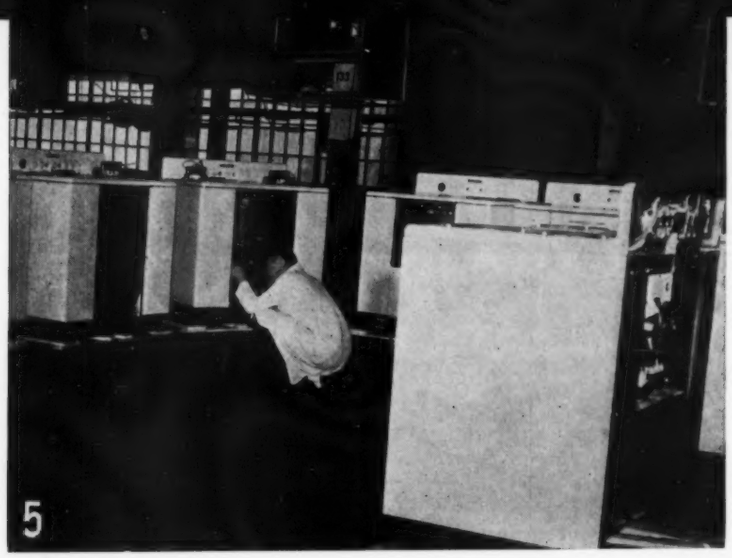


ALL WIRING IS INSPECTED and checked, especially for loose connections, as the range moves down the line. This is a 100 percent job. Every single connection is checked

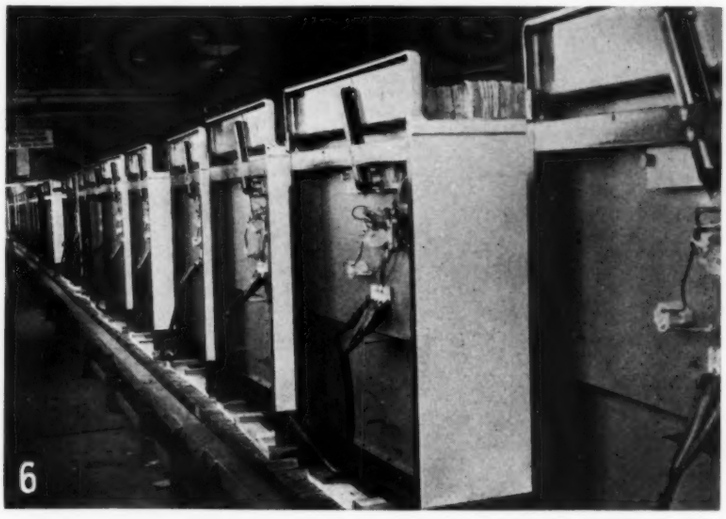


HE'S RE-CHECKING COLOR and giving a final once-over to the finish in the "Tunnel of Light," where there's shadowless lighting of 200-foot-candle intensity in the center of the room

THE RANGE IS GROUND TESTED at 900 volts. Each switch and corresponding surface unit is checked at each switch position for wattage. Complete electrical inspection here



RANGES REJECTED FOR ANY REASON are detoured off the main line to this horseshoe conveyor, repaired, then painstakingly re-inspected



THERMOSTAT IS CALIBRATED TO OVEN at this point on final assembly line; each range has been plugged in on an electrical conveyor.

OVER-ALL INSPECTION OF PACKING as the range reaches the end of the line, is this girl's responsibility. Range is now ready for crating

WESTINGHOUSE
ELECTRIC & MANUFACTURING COMPANY
MANSFIELD, OHIO, U.S.A.

THIS RANGE HAS BEEN TESTED AND INSPECTED CAREFULLY
RETURN THIS TAG WHEN REPORTING IRREGULARITIES

INSPECTOR'S NUMBER _____ CRATE NO. _____

STYLE NO. 1147909 SERIAL NO. _____

SHIPPING COUPON

STYLE NO. 1147909 SERIAL NO. _____

CRATING COUPON

STYLE NO. 1147909

STYLE NO. 1147909 SERIAL NO. _____

DATE _____

		DENTED	SCRATCHED	MISSED UP	MISMATCH	DEFECT	MISSING	LOOSE HDWARE	LOOSE	COLOR	CRAZED	CHIPPED	BROKEN	ALIGN	ADJUST
COLOR NO															
H'DWARE INSP. #	WIRING														
	TERMINAL														
RECHECK INSP	B. SPL.														
	CRATE														
	COMP. DR.														
	F. FRAME														
	HINGE														
	L.H.—B.P.														
MECHANICAL INSPECTION #	OVEN														
	O. DOOR														
	PLATFORM														
	REAR OF RG.														
	R.H.—B.P.														
	SIDE SPL.														
	SHELL														
	TOP PANEL														

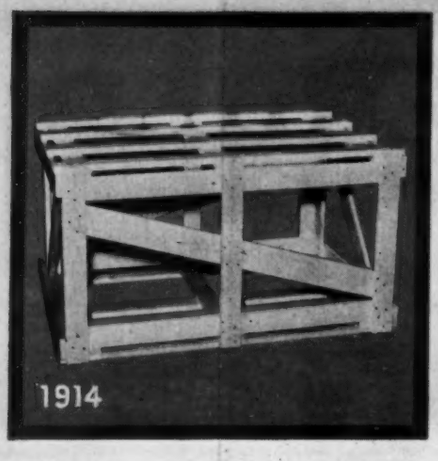
OPEN ☐	SHORT ☐	WIRED WRG. ☐	ELECTRICAL TEST
GROUND ☐	RELAY OPR. ☐	THERM. OPR. ☐	OK. #
WIDE DIFF. ☐	HIGH ☐	TH. MECH. REJ. ☐	THERMOSTAT
NARROW DIFF. ☐	LOW ☐	☐	OK. #
NO. DIAG. ☐	REPAIRS OK. ☐	EQUIP. OK. ☐	FINAL
CLEAN ☐	NO STICKER ☐	OVER ☐	OK. #

Still Not Satisfied

EVEN AFTER ALL THE FOREGOING TESTS have been made, the Quality Control Department isn't satisfied.

With the fast tempo of modern high-speed production, some errors might occur and minor defects creep in. So, acting as the consumers' representative right inside the manufacturing plant, the Quality Analysis Laboratory draws two ranges out of each shift's production.

These two ranges are then subjected to the most comprehensive tests. Conditions that might cause customer complaints are thus eliminated before they even have a chance to develop. Defects, even of a very minor nature, are corrected, removing the possibility that they might be multiplied in production. The Laboratory's work discloses not only the trouble, but also the cause of it. And that condition, whether in the receiving department, on the assembly line, at inspection points, or anywhere else, is immediately remedied.



Better Crating Saves $86,400

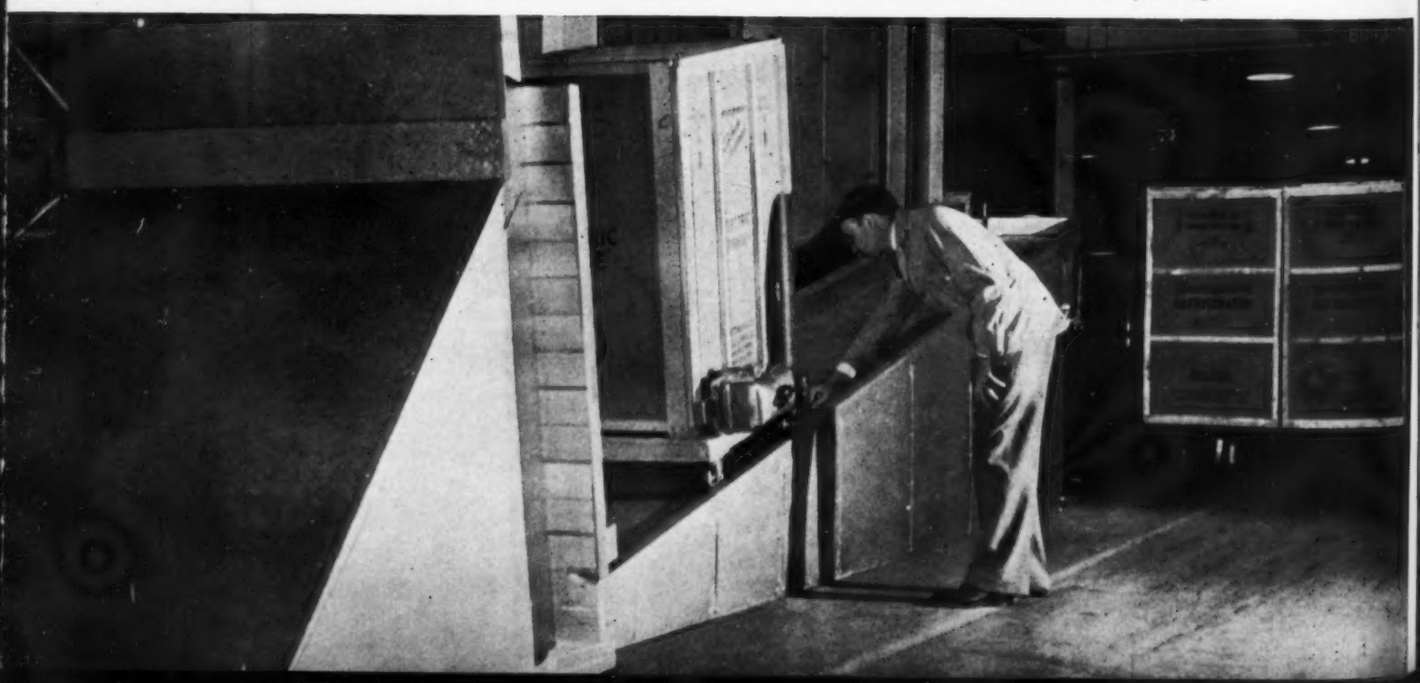
ALL PRIOR QUALITY CONTROL efforts have been wasted if packing is inadequate. Westinghouse is constantly studying the packing problem in order to:

1. Carry the product to its destination with minimum possibility of damage.
2. Develop the most economical container.
3. Find the simplest crating procedure.

Westinghouse began with heavy open wood crates, used them from 1914 to 1931. In 1935 the inclosed crate was introduced, and a year later the "floating" method was adopted.

Packing engineering has not only improved quality by reducing the number of ranges damaged, but it has also cut packing costs. This reduction in 1940 amounted to $86,400. To us, another illustration that quality control has earned its position in modern manufacturing, by effecting savings that assure a finer product at lower consumer cost.

TRANSPORTATION TESTER ELIMINATES THE HUMAN ELEMENT and all guesswork. This test, known as the "conbur" and developed by the Freight Containers Bureau of the Association of American Railroads, tells whether the crate is sturdy enough



The men who inspect engine parts under defense pressure must have shadowless light. It's fluorescent at Pratt & Whitney Aircraft

Defense—Its Impact on Morale

One company's experience. Reported to *Factory* by a *bona fide* member of the Pratt & Whitney Aircraft "Rover Boys" (hereinafter described)—who thereby had a first-hand opportunity to size up what happens when an employee-relations-minded plant goes all-out for defense

ABOVE ALL ELSE the working man wants security; with it he wants opportunities for bettering himself, and time for leisure whether that leisure be devoted to study, billiards, gardening, or baseball.

He is a proud individual—proud of himself, his skill, his home, his community, and his country. He also wishes to be proud of the company he works for. He must be, if he is to become more than a transient taking employment wherever better working conditions prevail at the moment.

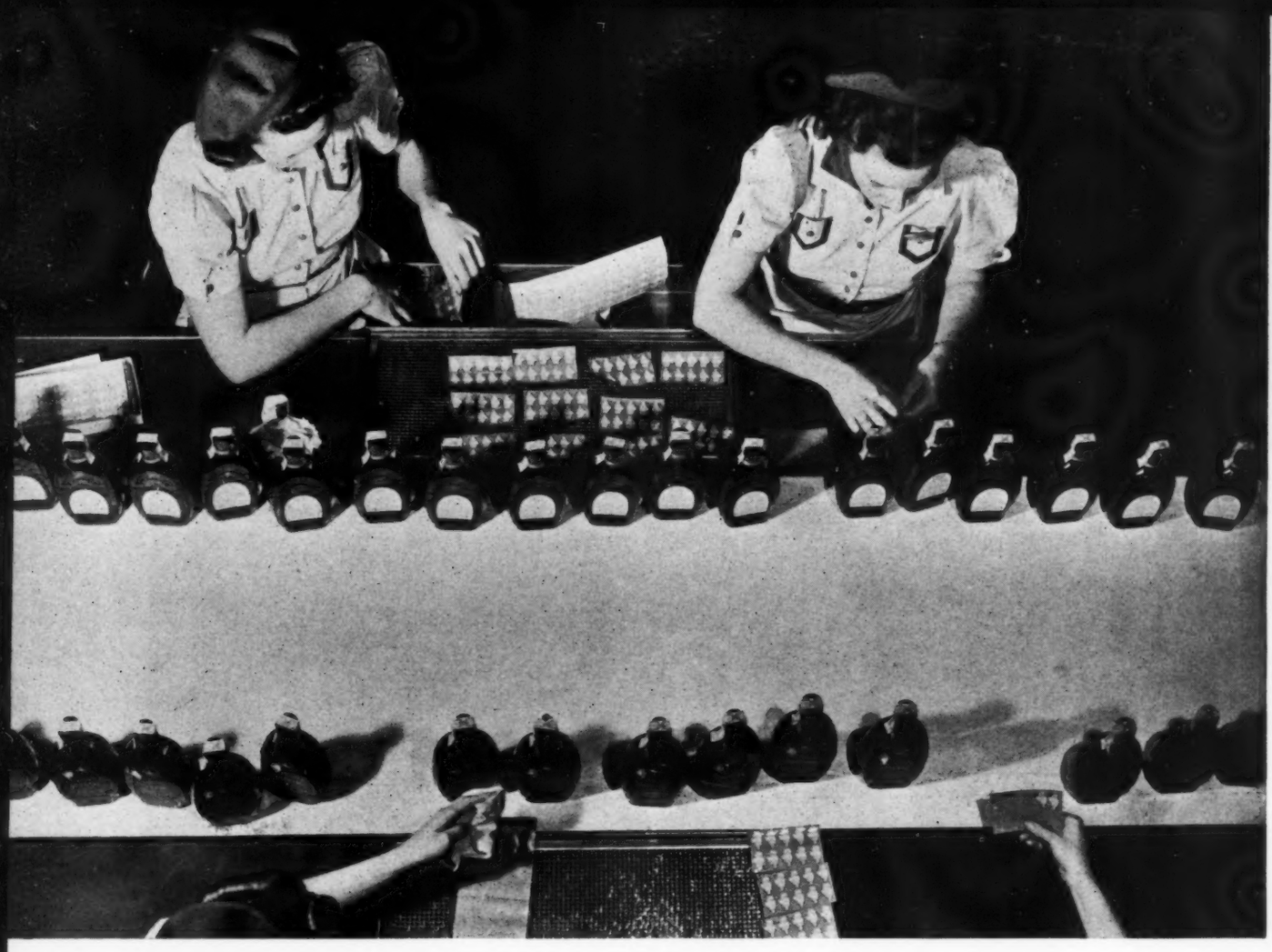
He wants to feel that his company is part of him, just as he is expected to be part of it. The product he helps to produce must be a personal thing to him, something in which he can take pride.

One of the plants where this spirit exists, is Pratt & Whitney Aircraft at East Hartford, Conn. There men at their machines will pause when a test ship roars across Rentschler Field and circles the buildings in its pull for altitude. At the lower end of Plant E, near the test hangar, there is an atmosphere of restrained excitement, like the moments before the paymaster arrives, when a ship in which experimental engines have been installed is rolled onto the runway for the motors to be revved and adjusted. The men have obvious difficulty in keeping their minds on their jobs, and one by one—the girls, too—they will saunter over to the windows to stare possessively. If anyone attempted to explain some function or operation he would be met with a haughtiness which implied, "Fool, I helped build that machine—you can't tell me anything about it!"

This spirit must of necessity come from the tradition that Pratt & Whitney has created since its small but successful beginning, in an industry in which nothing was certain, and the merest chance idea of an unheard-of employee might revolutionize production, or lead to an entirely new design.

Pratt & Whitney Aircraft was started in 1925 with a handful of employees in a converted tobacco warehouse. Within its first year, it had made an engine more powerful than any American engine of its kind then in existence. This was the first of the now world-famous "Wasp" series, the first successful high-powered, air-cooled aircraft engine. Now in excess of 1,000,-

(*Continued on page 164*)



Four girls affix 120 state tax stamps a minute (usually decalcomanias), since they have been provided with a tray that allows proper soaking time and a draining space. One tray serves two operators. Bottles remain on conveyor to get this decoration

Easier-to-Do Jobs Get Done Faster

Calvert Distilling Company applies work simplification principles to dozens of "little" operations. Dollar savings on some of these jobs run as high as 33 percent

ARTHUR VAN VLISSINGEN

Consulting Editor

DESPITE THE UTMOST CARE, in a fast-moving production line some work will fall short of standards and require reclamation. In a bottle-labeling line, some labels will be torn or smeared or askew. The traditional method is to set these defective units aside at the inspection stations. Then, a girl rubs a wet rag or sponge on the bottles, throws a damp towel over them for a quarter-hour or until she is ready to tackle them. Eventually, she scrapes off the damp labels, sets the bottles back on the conveyor to go through the labeling process again.

In the packaging operations of The Calvert Distilling Company at Louisville, this was the method used in the old plant. It kept one girl busy scraping labels to serve each double labeling line.

When Calvert moved into its new finished goods plant not long ago, stainless steel sinks had been provided —one sink for each packaging line, at the point where all labels have been affixed on the line. A girl is in charge of each sink. Depending upon what size bottle is being run, she draws enough water in the sink to reach up over the labels, but not high enough to touch revenue stamps. Calvert has one experimental sink with an adjustable control that holds the water at the level it is set for, and lets fresh water run through the sink continuously.

Every once in a while the operator gathers up into a stainless steel tray on a dolly the bottles rejected along her lines, takes them to the sink, and stands them in the water. Then she goes to her other job, which is relief or utility operator on the labeling line. As she completes her work on the line, she returns to the sink. The labels have by this time soaked off. She lifts out the bottles, wipes them, sets them back on the line for re-labeling. Then she puts another batch of rejects in the sink, and repeats the work cycle.

Because the job no longer requires an edged tool, cut fingers have been eliminated here. Actually, the girl spends about two-thirds of her time assisting and relieving on the bottling line, where previously it required full time to scrape labels. This means that for the four double lines of this plant, the wage saving is the cost of 2-2/3 operators. At the current wage scale, this saving totals close to $12 a day—which is a nice rate of return on the cost of four stainless steel sinks. There is another saving, intangible but real, because this method keeps the line relatively clear of rejected bottles and thus permits the regular operations to be carried on with fewer obstacles than before. Savings on lost-time accidents and minor injuries to operators also are considerable.

Better Techniques

Calvert incorporated in the new bottling plant a good many machines that perform operations formerly done by hand. These do not count as work simplification. Rather, they are labor-saving mechanization, which any production man would take advantage of when equipping a new factory. But the new plant contains literally dozens of little methods of bettering techniques, reducing motions essential to perform a given task, cutting down time and cost of doing the job.

For instance, on Calvert Special and Calvert Reserve Whiskies, the old labels consisted of four pieces: a neck ribbon, which crosses at the upper front of the bottle; a medallion covering the ribbon ends; the face label; and the back label.

On previous packing lines, one crew of girls removed the bottles from the belt conveyor and applied the neck ribbons and medallions. Successive crews of girls applied each of the other pieces. That way, 35 operators turned out 105 labeling jobs per minute.

Specific credit for each fraction of the subsequent saving cannot be allocated because several improvements

No cut fingers—and savings close to $12 a day, by using stainless steel sinks shown between conveyor lines. Labels that cannot pass inspection are soaked off in the sinks; the bottles are dried and put back on the conveyor without wasting anyone's time

Cartons of new bottles (packed upside down) arrive at the bottling line, are turned over to remove bottles, and tossed onto the cleated booster belt that takes them to packing. Bottles go, evenly spaced in single file, on a chain link conveyor into process

came at about the same time. The medallion was made a part of the face label, doing away with one separate piece. Gummed labels were substituted for ungummed labels; this permits one girl to affix both the face label and the back label, and eliminated the need to wipe off surplus paste.

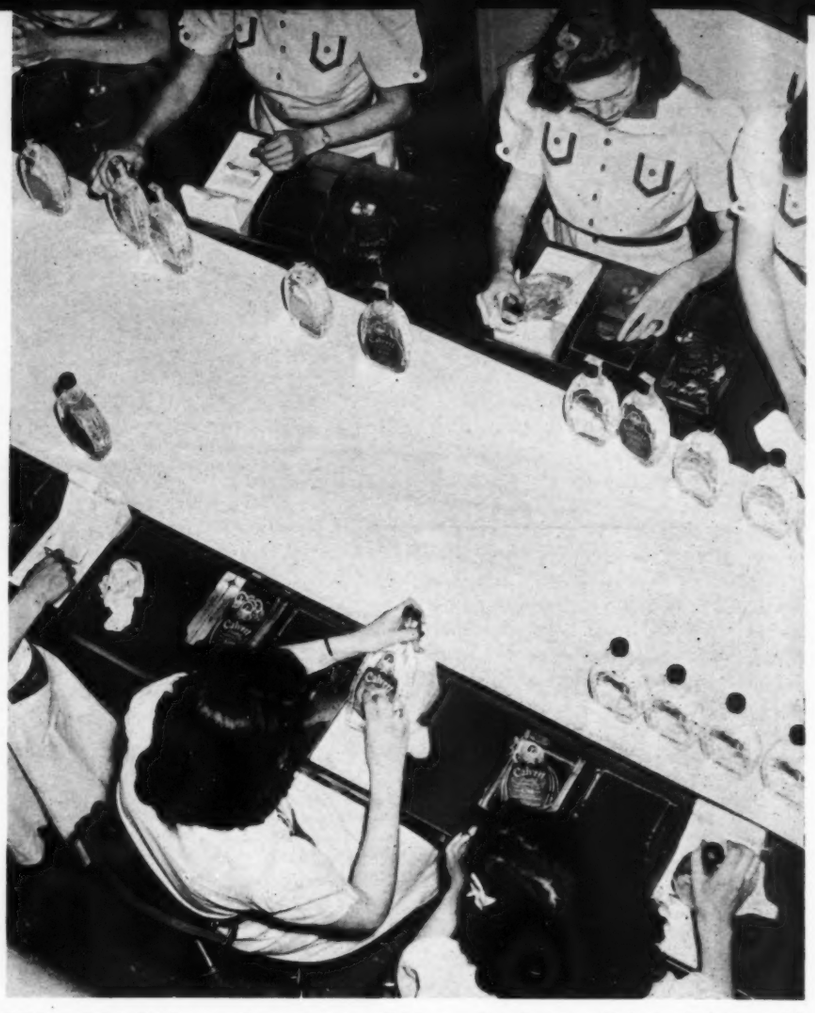
The new plant's labeling stations are equipped with specially designed trays of stainless steel, one for each operator. The tray is 10x18 inches, fits the 10-in. table ledge alongside the conveyor. Each tray has four sections. The left-hand section holds a white rubber jig like a pillow block, made with indentations and notches to accommodate firmly, in a handy position for affixing labels, each of the 10 shapes and sizes of bottles used in this department. The upper right-hand space in the tray is occupied by the moistener. The lower right-hand space is divided into two parts, one of which holds the face label and the other the back label.

No Lost Motions

Inspection of the photograph on the right shows the motion economy that this makes possible. The girl removes the bottle from the conveyor with one hand (whether left or right depends on which side of the conveyor she occupies). With the other hand she meanwhile replaces on the conveyor the bottle she has just finished labeling. Placing the bottle on the jig with the back-label panel up, the operator with her right hand removes a back label from its section of the tray, threads it through the moistener, and applies it to the bottle. With her left hand she then turns the bottle face up. Now the ribbons, which are held at all times in the hand (right or left, depending upon whether she is right-handed or left-handed) are applied around the neck of the bottle in a sweeping motion of the right hand. The thumb of the right hand has previously picked up a drop of moisture as it passed over the moistener, and this water is applied to one end of the ribbon while the left hand holds one end of the ribbon in place. The moistened end, pressed down by the right thumb, overlaps the other end of the ribbon and thus insures adhesion of the ribbon label to the bottle. The face label is now applied with the same motions as were used in applying the back label. This completes the cycle.

On the new line, where each operator does all three label jobs using the improved methods, production for the entire line has been stepped up from the old line's capacity of 105 bottles per

(*Continued on page* 172)



All brand label jobs are done at once. Each operator has a stainless steel tray with four sections. One section holds a white rubber jig, notched to hold all types of bottles; the second, a moistener; the third and fourth, labels for front and back

A bottle whose contents are less than crystal clear, or which shows a defect in the glass, can't get by an inspector who sees it through a 14-in. magnifying glass, against a bright field of diffused light. Saving: 33-1/3 percent inspection time; no fatigue

Budgeting for Varying Volume

Cost data are not hard to collect. Big problem is how to present them to management in usable form. Ultimate aim, of course, is to adapt them to future operations

E. H. KRAFFT and H. F. KING

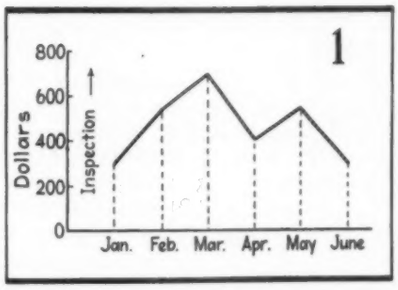
Factory Management Department
Sears, Roebuck & Company, Chicago

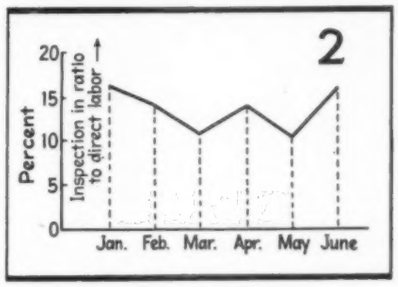
COSTS OF MANUFACTURING, purchasing department acumen, and the technological rating of production methods are reflected in the cost of sales. The inter-industry competition induced by a buyer's market necessitates a critical examination of each element included in the cost of sales. A manufacturing company whose operations warrant the absorption of the cost accounting burden, has the necessary mechanism required for the determination of the various cost elements. The problem usually resolves itself primarily into one of presenting these data to the management in the most usable form. The ultimate aim in the accumulation of data on past performance should be directed towards their adaptability in the budgeting of future operations under conditions of varying volume.

The problem may be somewhat simplified by assuming that certain elements of the cost of sales will remain fixed for a given period. Suppose, for instance, that the method of manufacture is standardized, that the wage scale is fixed for each classification, and that purchasing commitments have been made. The actual details of the wage payments, whether piecework, individual or group bonus, incentive plan or hourly rate, are important only to the extent that the cost of direct labor shall be a simple function of the cost price of each unit.

Only in special cases where properly weighted factors are applied is it possible to compare ratios of production expenses to sales. An example of one of these cases would be an industry whose sales were not affected by seasonal trends. Since one of the social aims of management is to stabilize employment conditions from the standpoint of minimum labor turnover, it generally follows that during periods of low sales volume the flow is into finished goods inventory. Conversely, when sales exceed manufacturing capacity, the finished goods inventory is decreased by the excess of sales over production. It is evident, therefore, that during periods of low sales volume any measuring element based on the ratio of production expenses to sales, will be higher than it would have been under conditions of increased sales.

In building up the case for a measuring element, based on direct labor, let us take as an example the inspection function in a single department. It will be assumed that job analysis and classification has shown that one inspector at $250 per month can function properly with less than 20 elements of direct labor at $100 per month each. Obviously if the size of the department





is increased, an assistant will be needed. Expansion of direct labor elements to 35 probably will require a second addition to the inspection staff, and a third man would be required when 60 men are on the payroll. Let us assume that each assistant is employed at a salary of $150 per month. The following tabulation gives the relation between cost of inspection and the number of men directly employed:

Number of Men	*Monthly Dir. Lab.* $	*Cost of Insp.* $	*Ratio of Insp. to Dir. Lab.* %
5	500	250	50
10	1,000	250	25
15	1,500	250	16.6
20	2,000	400	20
25	2,500	400	16
30	3,000	400	13.3
35	3,500	550	15.7
40	4,000	550	13.7
50	5,000	550	11
60	6,000	700	11.7

Suppose further that the monthly production ratio results in the following payroll for direct labor and inspection:

Month	*Direct Labor*	*Inspection*
Jan.	$1,500	$250
Feb.	4,000	550
Mar.	6,000	700
Apr.	3,000	400
May	5,000	550
June	1,500	250

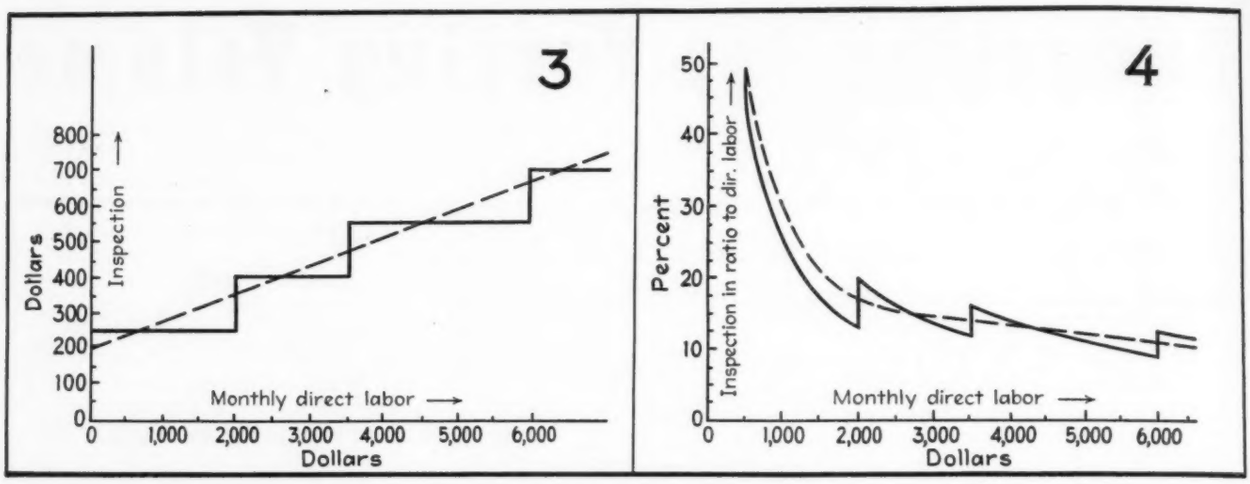
In Figure 1 the amount of money spent for inspection is shown. Figure 2 shows the ratio of inspection to direct

ERNEST H. KRAFFT

Born 1895. After serving during World War I in the Aviation Corps, finished engineering studies and worked in construction office and shops of different important companies. Has participated in the development of excavators, steam shovels, locomotive cranes, and so forth. Later founded his own company and manufactured measuring tools. Has been working for the past two years in the general factory management department of Sears, Roebuck & Company

H. F. KING

Graduated Massachusetts Institute of Technology, ScD.; research associate, Mechanical Engineering Department and Division of Industrial Cooperation and Research, Massachusetts Institute of Technology; consulting engineer; former chief engineer of Murray and Tregurtha, Inc.; and vice-president, Shore Corporation. Sigma Xi. Has held membership in the following societies: ASME, SAE, AIEE, IRE. Is now in Sears Roebuck & Company's factory management department



labor. These graphs show quite clearly how by increasing direct labor the amount of inspection cost is also increased, but the ratio of this expense to direct labor is decreased. These graphs show the tendency of the percentage to decrease because of increasing production, but they do not show *how* it should decrease. In other words, they do not disclose the trend which these expenses should follow.

This trend can be indicated by arranging the direct labor by increasing amounts and plotting the corresponding costs of inspection on a vertical scale. Figure 3 shows the increase of inspection costs that result from increases in direct labor. Figure 4 shows the decreasing percentage under the same conditions. To indicate the trend more definitely, broken lines have been inserted to indicate the average.

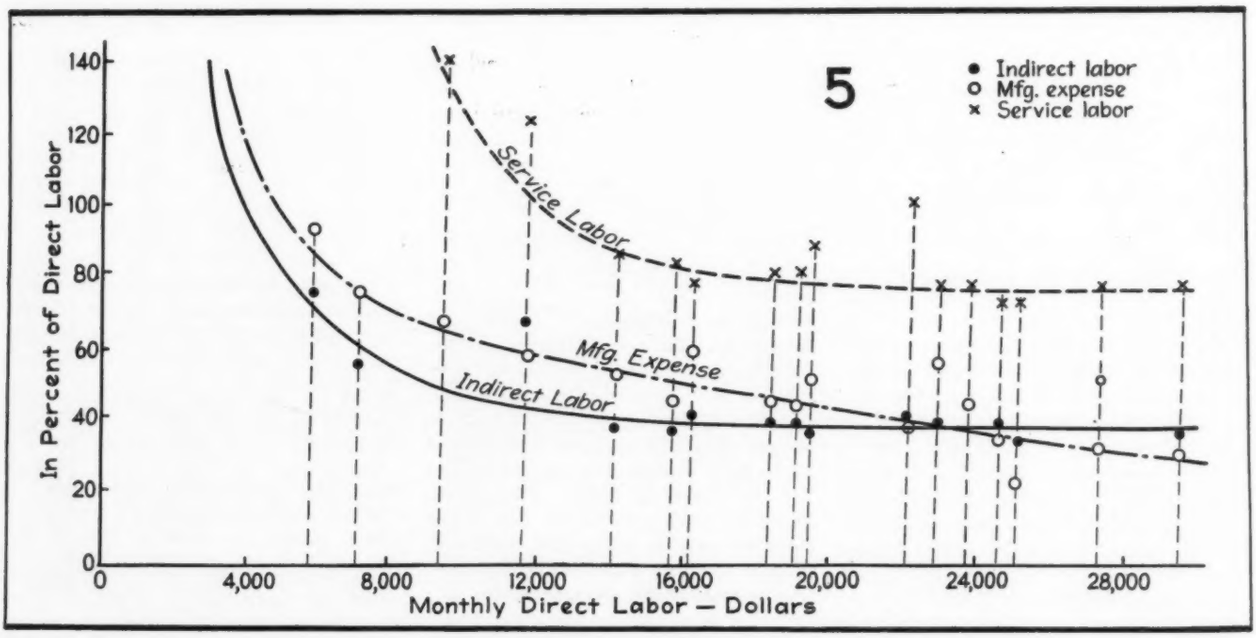
The graphs show the average trend, indicating how expense should change if production capacity changes. They are, to a certain extent, a means of control, indicating the inspection budget required for a fixed amount of direct labor.

A similar trend plot may be constructed for all expenses dependent on direct labor, such as supervision, inspection, trucking, all kinds of indirect labor, service labor, supply expenses, power, and light. It is possible, therefore, to control in this manner each item at each production center. Expenditures dependent on sales, such as administrative and selling expenses, may be studied by using the sales volume instead of direct labor as horizontal base.

No difficulties will be experienced in setting up more comprehensive graphs showing the complete variable overhead, administrative expense, etc.

Average values are always plotted, because human elements are involved. Therefore the actual results will not always coincide with the average line. In Figure 5 are shown the average trend lines for three major parts of the variable overhead. The actual performance is indicated by the plotted points. The abscissa shows the monthly amount of direct labor, while the ordinate shows the ratio of the subject expense to direct labor. For example, consider the month when $14,000 direct labor was consumed. The expenses fit very closely to the average trend line. During the month, corresponding to a direct labor expense of $11,500, it will be seen that the manufacturing expense was correct, but indirect labor and service labor were excessive.

(The concluding installment of "Budgeting for Varying Volume" is scheduled for an early issue.)



Management Shorts

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary management accomplishments. Accepted articles will be paid for

MATERIALS HANDLING, MOTION ECONOMY

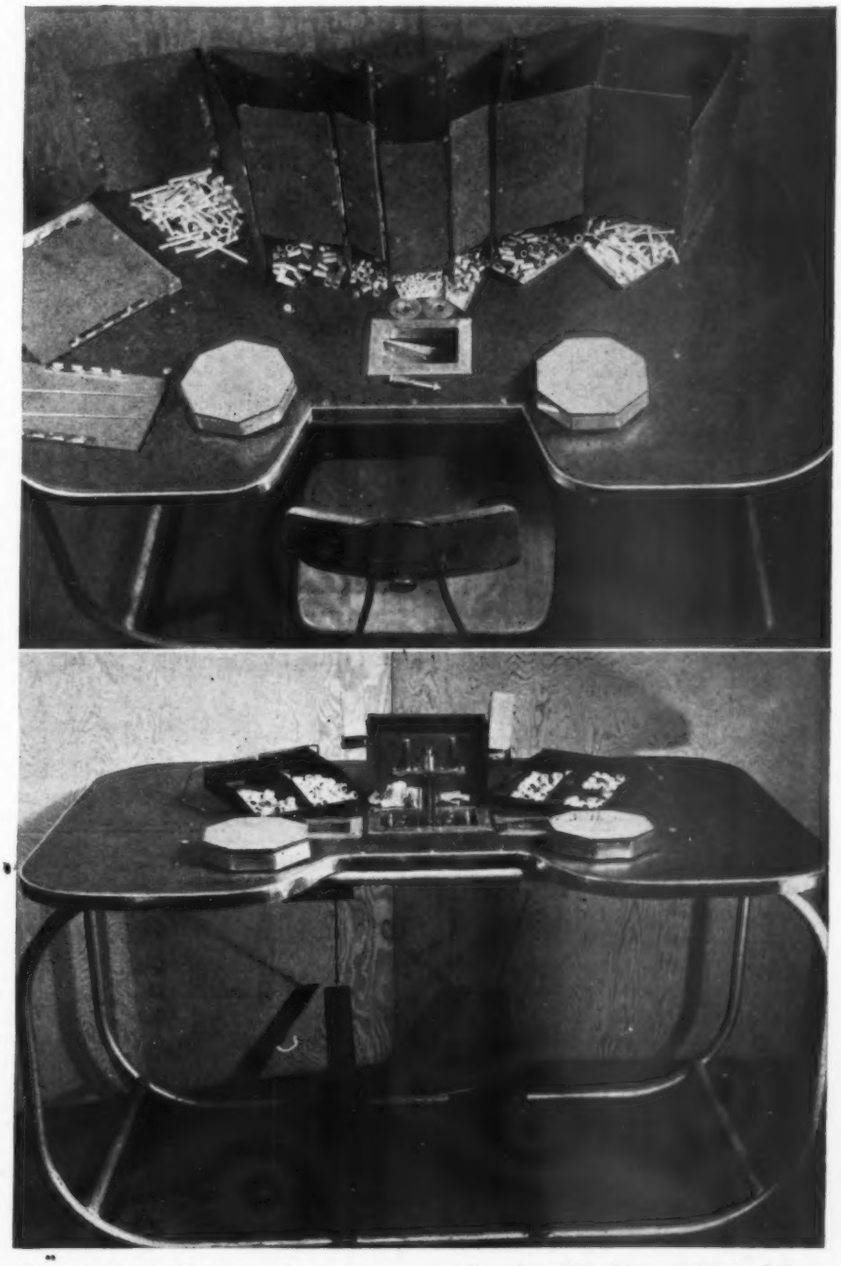
Built Motion-Economized Work Tables for Assembly

E. H. SCHAEFFER, *Industrial Engineer*
J. E. Ogden Company
Bayonne, N. J.

The two work tables shown are several of a versatile and attractive set we have had specially made. The chassis are of welded ¾-in. standard pipe, and cost about $8 each. Tops are cut from ¾-in. plywood, surfaced with ⅛-in. tempered pressed wood masonite. The molding is polished aluminum. Cost for material and labor is about $7. The tops are in one piece, and are interchangeable with any chassis. The weight of the table is about 35 pounds.

The double foot pedals shown in one view may be easily attached when necessary, forming a restful, balanced foot action for light foot-press work. It is not necessary to lift the entire weight of the leg on every stroke as on most presses; further, the individual foot pressure required to operate the press is split in half and balanced half on each foot. This eliminates much strain and fatigue commonly associated with foot-press work. Two standard press movements are possible on each table, one horizontal and one vertical. One or both are easily applied or removed as necessary, and both work with the same foot pedals. An effort has been made to standardize on a sound motion-economized work place. We have deviated from the conventional "circular work place" which feeds parts to a semi-circle in front of the operator. A close investigation of this type work place reveals that arms must move forward and backward, hinging at the shoulder, in process of moving parts from the feed hoppers to assembly jig or work area. The new work place feeds parts into two semi-circular bands radiating from the center of gravity of each lower arm, the width of the band being determined on the outer circumference by the position of the outstretched fingers and on the inner circumference by the position of the fingers at 45 degrees to the hand. This is the comfortable transport band usually about two inches wide, and it is within this band that the lips of prepositioning trays should be located.

The table is cut out to permit positioning of swiveling elbow rests which relieve the weight of the arm from the shoulder and allow for free, comfortable swing within the transport band. The elbow rests serve as a means of fixing the work path of the hand. They are positioned so that when the elbows are in line with the center of the body the



Constructed according to motion economy principles, the tables lessen operator fatigue

center of gravity of the lower arms is directly over the swivel posts. In some cases stops have been put on the rests to help in locating the terminal points of the hand transports. The elbow rests are made of a wooden disk on which is fixed a piece of 1-in. sponge rubber. A small piece of drill rod threaded from the table chassis serves as a hub, and a bushing in the center of the wooden disk provides easy bearing for necessary swivel action. This type of rest pulls the elbows back to a normal healthful position, allows the body to remain erect while working, and permits the chest a greater expansion than old tables which required leaning over and pushing arms forward to secure a rest for the arm.

The tables are fitted with fixture wells for easy mounting of simple jigs or dies and contain drop delivery holes with attached chutes. In some cases counters along the chute slide facilitate the combining of counting and packing with the assembly operation, as the packing box may be placed at the receiving end of the chute. Posture chairs, good light, and minimum noise are used to help in eliminating fatigue.

•

Support for Shaft or Long Rods

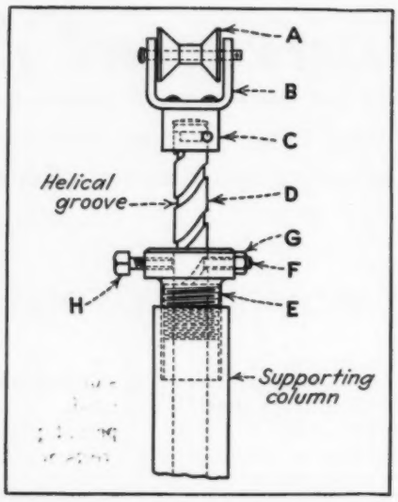
W. M. HALLIDAY, *Baildon, Yorkshire, England*

The illustration shows a type of support easily constructed and suitable for several purposes, which I used some years ago. Since this support has several advantageous features it may be of interest to other readers.

It will be seen from the sketch that *A* is a V-shaped roller carried on a pin passing through the vertical cheeks of *B*, a U-shaped bracket piece. We used several types of rollers, depending on the class of work handled. With black or unpolished stock, mild steel rollers were used but for polished work, brass rollers were employed. When aluminum tubing had to be supported, a V-shaped hardwood roller was found to be the most suitable for preventing scratching or marring of the surface.

Piece *B* is riveted to the blind end of bushing *C*, which is bored out to be an easy fit over the plain end of rod *D*. A small pin passing through this bushing holds it on the rod, but permits it to rotate freely.

Rod *D* is made of any desired length and provided with a helical groove from end to end. This rod slides freely inside bushing *E* which has an enlarged, headed portion in which is located screw *F*, whose inner end meshes with



the groove. This screw is locked to the head of the bushing by nut *G*. Located diametrically opposite is clamp screw *H*. It is made of brass and serves to tighten rod *D* in the bushing.

Bushing *E* is threaded on its smaller diameter to screw into the threaded bore of the supporting column. The upper end of *E* is knurled to give a finger grip. The supporting column is provided with a hole slightly larger in diameter than rod *D*, which passes through it.

The column is mounted on a stiff baseplate resting on small casters for easy portability.

The advantages provided by this construction are that settings in the height of the roller may be made rapidly, even when there is considerable difference in the heights required, as when changing from one machine to another.

To make a setting, irrespective of the height required, screw *H* is released and rod *D* adjusted approximately to the height desired. Then the screw is tightened, thus clamping rod *D* in the bushing. Finer adjustments are made by turning bushing *E*, as will be evident from the sketch.

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A $7,900 Bundler Pays Out the First Year

SOURCE
Package Machinery Company
Springfield, Mass.

Advantages of machine over hand bundling stick out all over the experience of a pipe tobacco concern. It has been paying $6.50 a thousand for its 1-doz. containers. Paper and end seals, used to replace these containers, will cost $3 a thousand, providing a saving of $3.50 per thousand bundles.

Figuring average production at 6,000 bundles a day, the daily saving will be about $20. On the basis of 250 working days, the annual saving is $5,000. Decreased weight, it is estimated, adds another $2,500 in freight savings. On top of all that, the company is looking for a labor saving of some $3,000.

Total savings are thus estimated at something more than $10,000. The machine costs $7,900—will thus pay out the first year.

Management, How Good Is Your Control?

Ask yourself these questions to check up

10. WASTE

1. Do you fully appreciate the importance of controlling waste? Do your men?
2. How often do you inspect for evidence of waste? What action do you take?
3. Are cleaning materials, part-cleaning acids, tools, small parts, miscellaneous stop nuts properly used, stored, and taken care of so that waste of these regularly used items can be held to the minimum?
4. Are you using too many rivets, too much masking tape, wrapping paper, electric current, compressed air, water, cleaning fluid? What can be done?
5. Is one responsible person designated to handle supplies? If you handle them personally, do you have a planned system of supply?
6. Are many parts being salvaged because of faulty cleaning, handling, or bench work? Because of faulty fabrication? What can be done about it?
7. Are parts being handled carefully by your section, to avoid scratching or warping? Is there much dropping of parts?
8. Are tools properly cared for? Used only for their proper functions?

Next Month: Instructions to Personnel

Prepared by HARDING PALMER, *Industrial Engineer*
Lockheed Aircraft Corporation, Burbank, Calif.

By a man who has spent 25 years in the front-line trenches of manufacturing industry. Who knows the foreman's job inside out. Who has met up with the same problems that confront the foremen of today. . . . For old foremen and new, these chapters from his forthcoming book are especially commended to the attention of the thousands of men who have lately stepped up into the supervisory ranks

FOREMANSHIP FUNDAMENTALS

A. L. KRESS
Industrial Engineer

A. L. KRESS has had a wide and varied experience. After 7 years on construction projects, from rodman to resident engineer, he became purchasing agent for a Canadian company making high-explosive shells. When we went into World War I, he worked as a civilian engineer on cantonment construction for the QMC.

Following that he went with United States Rubber Company, first as industrial engineer for a single plant, then for a division of ten plants, and finally as chief industrial engineer for the entire company. Over a period of 13 years he dealt constantly with problems of production control, plant layout and consolidation, standard costs, cost reduction, time study, wage incentives, new methods. At one time he supervised the training of more than a hundred time study men.

He served a year as Deputy Administrator for the Rubber Industry under NRA. Went with the National Electrical Manufacturer's Association in 1934 as Director of Code Administration (NRA) and then as Director of Industrial Relations. Was "loaned" to the National Metal Trades Association in July, 1938, to direct its new job rating program, later became its Director of Industrial Relations. Is now engaged in consulting engineering. He is a graduate of the Harvard Business School.

Kress is best known for his activities in the promotion and application of job rating, on which he has spoken and written widely. His "How to Rate Jobs and Men" (Factory, October, 1939) is perhaps the most significant contribution to current management literature in that field.

Forty-fifth in the Series of FACTORY MANAGEMENT and MAINTENANCE Plant Operation Library

I. What Men Respond To

You may have watched an organist play a pipe organ. His hands flash back and forth across the keyboards, his feet move over the pedals, and the big organ responds. Even the human voice can be imitated. The organist knows the stops to pull and the various combinations that will give him the glorious music he wants. The organ, inanimate though it be, responds to his sure touch.

So it is in dealing with people. If we know what men respond to, we can consciously play on their temperaments and reactions in order to bring out the best that is in them.

We say someone knows human nature. What do we mean? Simply that he has sized up people, studied them, analyzed their reactions, and reached certain conclusions as to what people will usually do, and why they do it, in different situations. In short, he *understands* people, and understanding is at the base of working with others. Of course, we have to be humble about this because we cannot always be sure how persons will act. There are, however, some fundamental motives or instincts that move all of us.

Basic Motives or Instincts

Human nature is complex. It is often difficult to understand. Back of it lie certain basic instincts or motives which we all possess in varying degrees or combinations. Remember, men do not check these emotions at the factory gate and pick them up again when they go home at night. They are always present. Sometimes you do not have to "get very far under a man's skin" to break through the veneer of modern life and get the same reaction you would have got a thousand years ago.

We need only list some of these instincts here. If you are not sure what they mean, look them up in any dictionary. Our real concern is to pass along to those motives that we can constructively play on, as leaders of men. We must, of course, keep in mind these basic instincts:

Ambition	Lust
Curiosity	Patriotism
Envy	Pity
Fear	Pride
Greed	Self-Preservation
Hate	Self-Respect
Love of Others	Sympathy
Love of Power	

Some of these motives are positive and constructive—and make society as a whole better. Others are negative and destructive—and are the reasons why someone has said "the Christian ideal has not been tried and found wanting, but has been found difficult and left untried."

Have you ever stopped to think what makes strangers rush to help others in an automobile accident on a highway? Or even the simple, unconscious act of trying to stop someone's hat when the wind blows it away? Or how readily men respond to grave emergencies, risking their lives for others whom they may not even know?

These are unconscious reactions, born of hardship and suffering, reaching back to those days when a small group of primeval men fought the saber-toothed tiger for mutual protection. In union there was strength. That is what history is, the story of the common man struggling to improve his lot in life, and learning to cooperate in a common cause.

We shall limit our discussion of this interesting field to the things that you, as foreman, can use to build morale, get out the day's work, maintain quality, and keep costs down.

Let us list some of these factors:

Ambition	Courtesy
Confidence	Example
Consideration	Fair Play
Consistency	Personal Interest
Constructive Criticism	Pride
	Responsibility
	Self-Respect

There are others, but we know that men and women in a factory organization will definitely respond to these things. Use them deliberately and consciously. Size up your personnel in terms of their individual personalities and see which ones you think are applicable to different persons. Let us see how we can do this.

Ambition

The American way of life is characterized by one basic principle—*that the individual may find his own level, according to his own ability.* He may make out of himself whatever he chooses, if he has what it takes. There have been no classes, castes, or artificial distinctions. If the time comes when there are class distinctions or "class consciousness," then, whatever else it is, it will no longer be America.

Almost everyone is ambitious. He would like to get ahead. True, some people spend their time in wishful thinking instead of applying themselves. Ambition, the desire to get ahead, to learn more, to be more valuable to the company and to society. Here is the stuff for "builders of men" to work with. The ambitious man is interested in three things:

1. To do well whatever task is now assigned him.
2. To qualify for a better job.
3. To develop an outside interest or hobby as a means of self-expression.

How can the foreman make the most of ambition?

1. Get the right man on the right job.
2. Fill vacancies by promoting from within the company.
3. Encourage men to study and improve themselves outside of work, even though it has no specific application to the job they are now doing.
4. See they receive the right kind of training on any job, so they may take pride in doing it well.
5. Train men to do more than one job.
6. If you cannot find a better job for a man within your department, help him get a better one in some other department or even in some other company.
7. Help young men get the right kind of vocational guidance.
8. Never stand in the way of advancement for anyone.
9. Never hold out false hopes for advancement.
10. Recognize the fact that further advancement is not always possible. Encourage outside interests in your men in such cases, since through these interests they may obtain satisfaction they would otherwise miss. This is what hobby shows do, for example.

Confidence

"Why, I know him. He would not do a thing like that. I just don't believe it was his fault," said the erection foreman to the superintendent. They were discussing a machine that the superintendent thought had got by the final inspector with certain defects. This is confidence. The foreman was sure it was not the fault of the man.

Confidence works two ways. The foreman must have confidence in his men. And, equally important, they must have confidence in him.

There are all sorts of stories floating around a plant. It means a lot when a man on a machine, who commands the respect of his fellow-workers, looks up

and says, "I don't believe it. I have worked here ten years and they don't do things like that around here. We haven't got all the story on that one."

Confidence is the bedrock on which all business is done. As a foreman:

1. Always keep your promises, particularly when it is difficult.

2. Be a man of your word. Do not promise what you cannot deliver.

3. Let your men see you have confidence in them.

4. Do not ask them to do anything you are not prepared to do yourself.

5. Remember "the captain rides the bridge in a storm." Be on the job when trouble develops.

6. Do not jump at conclusions about the conduct of your men.

7. Give every man a square deal.

8. Never try to put over a "fast one."

Consideration

Showing consideration for others is one of the simplest ways to win their respect and liking—for of course we do things for others because we like them.

Countless opportunities come up all the time where we can show consideration for the other fellow. For example, a man has been out with a long illness; he is anxious to get back to work, but is not too sure of himself. So you find a way to "ease" him into his old duties gradually. Or home conditions require the man to get in a little late each morning, so you fix it up. Or a man gets stuck with a job that will not work right and you throw in some extra help, instead of letting him worry it through. Or a man is taken sick and you see he gets home safely, even if you have to take him yourself.

A foreman would not *have* to do these things, but it will make his job a lot easier and a lot more worth while if he will. The idea that a leader of men must hold himself aloof, be hard-boiled, unapproachable, and "tough" was promoted by men who did not have anything else "on the ball." We should all be better off if we followed the Boy Scout motto of "a good deed every day."

In showing *consideration:*

1. Treat everyone alike—do not play favorites.

2. Be close enough to your men so you know some of their problems.

3. Know what goes on in your department.

Consistency

The story is told of a famous general that, whenever he left for a tour of inspection, the radio operator always managed to send out some routine report, with "B. L." scattered through it. The "B. L." meant "Bull Loose." Everybody was supposed to be prepared for anything. In logging camps, the foreman was often called "the bull of the woods."

Occasionally you see leaders who "put on a show." They may throw their hats on the ground, wave their arms, curse long and fluently. Some of the audience may enjoy it, but not the man who is on the spot. In children we call it a tantrum, which is just a fit of ill temper.

It may be spectacular and amusing, but it doesn't really make the wheels go. No one in authority can afford to indulge in these exhibitions.

These fellows who have to be "sized up" every day in order that those under them may know how to approach them, pay a price for their moods. They do not get told things they should know. They always lose the respect of their subordinates.

Men respond to a consistent leadership, where the foreman is not "way up" one day and mentally low the next, but where he runs along on the same even keel. Men always know where they stand with a foreman who is consistent in his attitudes, and they come to respect him for not letting events control his feelings. They say "he can take it." If you want to develop *consistency:*

1. Be approachable.

2. Do not tell a man one thing today and something else next week.

3. Have standards of discipline and performance and stick with them.

4. Never raise your voice if you have an argument.

5. If you get too angry, walk away and come back again.

6. Learn to overlook or not to see small things that do not count.

7. Watch your health. Do not get over-tired and irritable.

Constructive Criticism

In the old days, the motto of many superintendents and foremen was "treat 'em rough, tell 'em nothing, keep 'em guessing."

No one ever found out just what results this was supposed to give. It is easy to see how ridiculous it was. After all, what we want in industry is the man's interest, loyalty, and personal effort. He can give or withhold them as he chooses, and we may never know the difference. Clearly you cannot get them by following any such motto.

So this idea of "keep them guessing" has no place in the successful foreman's methods. Men like to know where they stand. They like to know what kind of job they are doing. If a man does a particularly good job, he likes to be told, to know it was appreciated.

Given in the right way, at the right time, praise leads men on to do even better. Sure, now and then it may turn someone's head. But there is something wrong if you cannot find one thing every day to commend someone for. Every man does better work if he is told when he is doing a good job.

Unfortunately there is not enough *constructive* criticism given to the man who is not doing a good job. Too many persons in supervisory positions do not have the "guts" to sit down and talk calmly and frankly with a man about his shortcomings. We are apt to criticize our subordinates to others, even to their fellow-workers (which is a grave mistake), but we seldom tell the man himself, face to face, where he is falling down. It seems so much easier to evade issues of this kind, but they have a way of catching up with us sooner or later.

If you are to be a "builder of men," you must analyze every man's performance in terms of concrete things such as quality, quantity, job knowledge, cooperation. And you must try to see what it is that prevents him from doing the most effective job. When you have done that, and are sure you have put your finger on the reasons, sit down and have a friendly, man-to-man talk.

Almost everyone welcomes constructive criticism, if it is given in the right way, because it helps us do a better job and shows someone is interested in us. Keep in mind these points.

1. Choose the right time to talk with a man. Be sure he does not have something else on his mind.

2. Think out what you want to say in advance. If you have any criticism, be ready to give specific examples to illustrate your points.

3. Start out by discussing some of the man's good qualities first. Get him in a receptive frame of mind.

4. Lead into some of his failings. Tell him only two or three at one time and suggest exactly how he can overcome them.

5. Never send him away discouraged. Make it clear that you are telling him these things because you think he can overcome them, and that you are prepared to help him do it.

6. Always talk concrete points and not generalities.

7. Talk with him again in a day or two to show him it is all friendly. You will probably get his reaction after he has thought it over.

8. Suggest to your company that it

adopt a sound employee rating plan to help you analyze your men.

Courtesy

One good indication of a man's character is the way he treats other persons in lesser positions. You know the type of man who brow-beats the file clerk, the telephone operator, the porter, the waiter. Nothing is ever right. He is not only rude but crude because he takes an unfair advantage of such persons.

There is only one rule for a person in a supervisory position. *Always be courteous to everyone.*

Courtesy is more than just being polite. It involves thoughtfulness of others. Suppose the foreman of the next department sends a new man to you for some material. You are sure he has not got the story right as to what is wanted. Now you can make it "tough" by playing up his ignorance, "riding" him, refusing to help him out in any way, and sending him back empty-handed. Or you can call the other foreman and make sure what he wants.

Perhaps you know someone who never speaks to his men when he comes in in the morning. Or who greets the man who walks into his office (always a subordinate, of course) with "what the hell do *you* want now?"

The courteous man controls his feelings, he never "takes it out" on someone who is in a lesser position. He is friendly but not familiar. He knows that courtesy pays because it saves time; it puts everyone in the right frame of mind at the start. There is no initial resistance to overcome.

Men respond to courtesy because it builds their self-respect. Even more important, it increases their respect for you.

Setting an Example

A factory organization always reflects the man at the top. He sets the example. If he is curt, hard-boiled, and unreasonable, the chances are his subordinates will try to imitate him. The group invariably takes its cue from the leader. Most people who are responsible for the work of others seldom realize how closely they are watched, their opinions and actions discussed, and their conduct criticized or imitated, by those under them.

So it is an essential part of your job to set a good example. If you criticise top management to your men, you can be sure they will do the same. If you belittle the work of a staff department, it will make the work of that department more difficult. If you laugh at the inspection department's standards or ridicule its inconsistencies, the men will not take it seriously either. If you are careless about getting in on time, your men will be too. If you are indifferent to good housekeeping, safety, waste, schedules, cooperation with others, your men will be too.

All there is to management is setting up standards of performance and seeing people understand what is expected of them. Standards of personal performance are just as necessary. Some people think the higher they get, the more liberties they can take. Usually it does not work out this way. The higher you go, the more rigorous your personal standards of performance must become, if you want to exercise real leadership. You can set an example and your men will respond, if you:

1. Do not ask anyone to do anything you are not ready to do yourself.
2. Discard the phrase, "That's good enough," or "I guess that will get by."
3. Insist on definite standards of performance, quality, housekeeping.
4. Be fair but firm.
5. Make it a point to work overtime, if you ask your men to.
6. Keep a friendly, cheerful attitude toward your problems and life in general.
7. Avoid destructive criticism, "knocking," peddling plant gossip.

Fair Play

Americans have a highly developed sense of fair play. Nothing irks us more than to see someone getting an "inside deal" or special consideration because he "knows somebody."

Since fair play is so deep-seated among us, it is particularly important for everyone directing other people to be completely fair in dealing with them.

This is sometimes difficult, because we have to put ourselves in the other man's position to see what his reaction would be. It is quite natural to do things for those you like.

For example, what would be more natural than to offer overtime work first to the man who has always gone out of his way in the past to help you out? You would never think you were singling him out for special consideration. Wasn't he always willing to come back when others refused? Yet his fellow-workers might almost be justified in thinking you were playing favorites, if you always went to him first.

So we have to be concerned about what other people think and whether they think something is fair. We may as well recognize, too, that it is harder to be fair to someone we do not like. But that is all the more reason to "lean over backward" in our dealings with him. Let us take a look at some of the possible sources of unfairness on the part of a supervisor:

1. *Wages*—differences in wages not justified by differences either in the skill of the jobs or the ability of the men.
2. *Assignment of work*—assigning work to men on any other basis than their ability to do the job well.
3. *Discipline*—letting certain men "get away" with something, or disciplining one man more severely than another for the same offense.
4. *Overtime*—failure to give everyone a chance at overtime work, provided he can do the job.
5. *Transfers and Promotions*—you are inclined to select those you like for promotion, particularly if they are to work with you. Do not pass over an otherwise competent man just because you may not like him. He is entitled to his chance.
6. *Time Off*—letting some men off for ball games, hunting, or fishing, without being prepared to let others off. You are entitled, of course, to consider a man's absentee record when you make your decision.

Finally, have definite reasons for the things you do. Be prepared to explain them if necessary. And do not do anything to or for anyone unless you are prepared to do the same thing to or for others who happen to be in the same boat, so to speak.

Taking a Personal Interest

Suppose you have a good assembler who could readily qualify for advancement, if he knew more about reading wiring diagrams.

What would be his reaction if you took enough personal interest in him to talk it over, outline a plan by which he can get the necessary knowledge, keep in touch with his progress, encourage and give him a chance to try out his newly acquired skill, on the job?

You know the answer. He could never do enough for you.

Get to know your men, know their interests, both in the plant and outside. Talk with them about their hobbies. Help them round out their job knowledge and experience. But make your interest genuine. If you like people, you have to take an interest in them.

Pride

Some people are proud of their ancestry, their children, their place in the community, or even their new car. Of course, like other things, it can be carried to extremes, but pride can be a

constructive force in shaping people's lives and actions.

In a factory we are concerned with a man's pride in his job. We want him to think the plant is a good place to work, that his own supervisor understands handling men, that he himself knows his job and can do it as well as or better than anyone. That is job pride.

Obviously *job pride* is one of the constructive things men respond to. You can build *job pride* in your men if you will:

1. See they have the tools and equipment necessary to do a good job.

2. Instruct them properly.

3. Put your own job knowledge at their disposal.

4. Give them a chance to learn more than one job.

5. Commend them for a job well done.

6. Put tough problems up to them for suggestions.

7. Use them as instructors for new men.

8. Develop interest in the job:

a. Place the man's name over his machine or workplace.

b. Use the department bulletin board to tell your story as to what orders are going through, what changes are being considered on layouts, methods, new machines. Ask the operators for their suggestions.

c. Post on the bulletin board comparative standings on scrap, output.

9. Never give a man an order when a direction or suggestion will be more effective.

It means something to say, "He knows his job," whatever that job may be. Never belittle any man's job. One factory manager insisted the word "common" be dropped from the job name of "common laborer." He thought if the men on that job knew it was called "common" labor, they would have no job pride.

Responsibility

In a factory organization everyone is responsible *for* something *to* somebody. That is what organization means, delegating or entrusting certain duties to the care of others.

Nothing develops people more than responsibility. Often we are surprised to see how someone rises to meet a situation. We say, "I never thought he had it in him." Most people *do* have it in them to do a better job if we only know how to get it *out* of them by enlisting their interest and enthusiasm. The great tragedy in industry is that so few people use all their abilities.

One of the surest ways to develop men is to put a definite job up to them, give them responsibility, see that they understand what is wanted, have what they need to do the job—and then hold them accountable for results.

You will be constantly amazed at the resourcefulness and ingenuity people show when they feel some share in the responsibility for results.

A maintenance department foreman was outlining his organization so that it could be put on the organization chart. He was inclined to belittle his assistants' duties, because he feared his own job might not be appreciated. He tried to make it appear that no one ever did anything unless *he* "pulled the strings." Of course it can't be done that way. You can get a lot done in a factory organization, if you are not too much concerned about who gets the credit.

The successful foreman instils a sense of personal responsibility in his men for quality, waste, costs, schedules, errors. He does this by making them feel they are a part of the team, by letting them know what the objectives are, by encouraging criticisms and suggestions, by giving them credit when due, by holding them accountable for results.

In doing these things, the successful foreman never feels he is lessening his own importance, because he knows he cannot do it all himself.

Most men respond to responsibility. Your task is to size them up, know their limitations, know that they are up to the task that you are assigning them. Sometimes you will find a man who shirks responsibility, but do not conclude that he is typical.

1. Use your departmental bulletin board to tell your men about waste, spoilage, cost of repairs, delivery dates of orders, production schedules.

2. Hold departmental meetings of your men to talk these things over.

3. Make every man feel he is his own inspector.

4. Show your men the importance of their work in the total picture.

5. Arrange for them to go through the plant and see all the operations.

6. In short, build up a sense of personal responsibility and accountability for the successful operation of your department, on the part of all your men. You will never regret it.

Self-Respect

Two people sometimes get themselves so far out "on the end of a limb" in a controversy that no agreement can be reached. Then someone has to step in with a suggestion that both will accept and that still enables each person to "save his own face." In other words, the solution must make it appear that both persons won the argument. "Face-saving" involves self-respect.

We occasionally hear it said, "No self-respecting person would put up with that." What is meant is that no one who sets any value on himself or who has any respect for himself would put up with some things.

Suppose you decided to discipline a craneman for breaking a rule, by requiring him to work a few days as a chip-wheeler or janitor. He would probably quit rather than submit to such action. He could not "save his face," he would "lose caste" with the men, and so make up his mind the only thing left was to quit. You would hurt his self-respect and probably subject him to ridicule. Ridicule never pays, since it may hurt the other fellow's self-respect.

Now self-respect can be a constructive factor in getting the day's work done, especially in maintaining quality, good housekeeping, and good working conditions. One of the best indexes of good management is plant housekeeping—the condition of toilets, washrooms, stair towers, whether departments and machines are kept clean.

Everyone reacts to his surroundings. If you want good workmanship, provide the facilities that will appeal to a man's self-respect. Any time you walk into a factory washroom that is dirty or offensive, you can make up your mind the men either curse every time they go in, or else their senses are so dulled by the fact the company does not care, that they take the same attitude toward their work.

When we appeal to a man's self-respect, we usually stimulate his interest in his work at the same time. These things build *self-respect:*

1. Provide and maintain good working conditions and personal conveniences.

2. Insist on a high standard of departmental orderliness and cleanliness.

3. Encourage suggestions.

4. See that each man understands the purpose of his job and how it contributes to the complete picture.

5. Help each man to get some personal satisfaction out of his job.

6. Talk about the department's problems to your men. Make them feel they are a part of the team.

Leadership

Twelve concrete factors to which men respond have been suggested to you. There is nothing theoretical about

them. They are simple, practical things to which we all respond. Think it over and see if you do not agree. These factors make for leadership, since they influence people to do the things you want done, willingly and with an acceptance of your right to tell them what to do. And that is the test of real leadership.

An eminent psychologist* says about *leadership:*

If you want to be a successful leader of people in a worth-while endeavor, these 21 traits should be developed or acquired:

1. Accept criticism cheerfully.
2. Read widely about your work.
3. Keep your spirits up when things go badly.
4. Encourage those working under you or with you to give you suggestions, and then be sure to act upon as many of them as possible.
5. Delegate responsibility and develop it yourself by "first teaching the fellow under you how to fill your job, and then trying to learn how to fill the job ahead of you."
6. Size up others closely, so that you are able to know what they can do and what they cannot do.
7. Learn to like to make decisions, and do not avoid making them promptly.
8. Keep free of prejudices by dealing fairly and squarely with others, regardless of their race, religion, or social standing.
9. Express your sincere opinions, without apologizing for them.
10. Praise others for their good work, but do not become a flatterer.
11. Criticize the work of others, but do not antagonize them.
12. Get the habit of concentrating under difficult conditions of light, heat, and noise.
13. Assume the responsibility for your own mistakes, without "passing the buck."
14. Examine your own decisions critically for a few minutes, before accepting them as final.
15. Speed up your time of making decisions, but do not go off "half-cocked."
16. Develop your way of speaking until your words sound as if you had confidence in them.
17. Make people feel at ease when you are talking with them.
18. Be consistent in your dealings with others.
19. Have a high sense of justice, but do not become "preachy."
20. Look people squarely in the eye.
21. Be able to enjoy a good joke.

Here, then, are the signposts along the road to more effective personal relationships with others. Aladdin's magic lamp could serve you no better than can these simple truths. Apply them, use them, see how much more personal satisfaction you will get out of your job as a foreman. If you have never thought of your job as a leader, in these terms, it will open up a new and satisfactory world to you.

*Laird: *How to Use Psychology in Business*, p. 366-7, McGraw-Hill Book Company.

II. Getting the Most Out of Your Day

"How is everything going today?" the industrial engineer of the Unum Company asked the foreman of the structural shop.

"Why, all right I guess, I don't hear anything," said the foreman. "You know how it is around here. The squeaky wheel gets the grease."

In a few words, that foreman, without realizing it, stated his own plan of supervision. He "played by ear." He waited for something to happen before he did anything, instead of trying to foresee or anticipate trouble. In short, he had no plan for covering his own job.

Getting the day's work out—planning production—is an important phase of the foreman's job. It is just as important for the foreman to plan his own day's work, if he is to cover all phases of his job. The foreman who comes in in the morning with a definite plan for supervising the day's work, is going to cover more points and cover them better than the foreman who comes in with nothing in particular on his mind, and waits for someone to "holler." The difference is between running your job and letting your job run you.

Needed: a Daily Routine

Of course, it is hard for a foreman to foresee every demand made on his time during the day. We all know nothing seems to go right some days. Still, that ought not to stop us from having some kind of daily routine. If a foreman kept track of all the things he did for a week and classified them, he would find they probably could all be classified under the following broad headings:

1. Routine Supervision.
2. Trouble Shooting.
3. Dealing With Personnel Problems.
4. Constructive Thinking.

In the pages that follow we shall discuss each of these four phases of the foreman's job.

Routine Supervision

If we take a look at the routine supervisory duties of the foreman, they break down into:

1. Getting the Day's Work Started.
2. Maintaining Quality Through Inspection.
3. Checking Up at the End of the Shift.
4. Giving Information From Time to Time.

For example, there are certain things that have to be done at the start and end of each shift. Who is absent? Did the mechanical department get that machine repaired last night? Where is that rush job the planning department said would be delivered at 8 a.m., which must be on its way by 3 p.m.?

The point is that these same things come up every day—perhaps in slightly different form, it is true. The foreman can make his own job easier by setting up a definite program for his own time, even though he has to change that program somewhat. There is, of course, no thought of suggesting that you set up a rigid timetable. When an unforeseen interruption comes up, handle it, and then go back to your plan.

Getting Work Started. This is the first concern when a foreman takes over a shift. He must quickly and systematically canvass the situation, and see what he has to do to man every job and meet his schedules. You cannot do this sitting at your desk. Time lost in getting the day's work started promptly means excess costs. Some or all of the following things have to be done:

1. Find out who is absent.
2. Make any shifts or transfers to

man all jobs. If you need extra men or have any you do not need, advise the superintendent or personnel department at once.

3. See that every man has a job assigned, and knows exactly what he is expected to do.

4. If you are taking over a shift, get there in time to check with the other foreman for any trouble or delay.

5. Order any material or supplies.

6. Make sure enough material is ahead at each machine or workplace.

7. In general, satisfy yourself that the necessary man and machine hours are available to meet your schedule.

8. Do not let yourself get tied up with a lot of clerical work. It may be necessary, however, to:

a. Make out daily absentee report.

b. Check and initial yesterday's time cards before sending to the payroll department.

c. Make up production or shortage reports.

These are only examples. If you will analyze your own problems in getting the day's work started, you can develop a regular routine which will be invaluable to you.

Maintaining Quality. The extent of the foreman's responsibility for inspection depends upon whether or not there is an inspection department. Even if there is, he is still responsible for the quality of work in his department.

Where there is no inspection department, the foreman must either assign someone to act as inspector or do his own inspecting. Even if he assigns one or more inspectors to maintain quality, the foreman should still spend some time "over-inspecting" to be sure standards are maintained. This means from time to time picking out or "sampling" a few pieces that have been passed, and re-inspecting them. The foreman may also re-inspect all rejects before repairing or sending to salvage.

If the foreman has to do whatever inspection is done, it is clear that he cannot inspect every part or piece. As a rule, the most he can do is to "sample" a few pieces regularly, setting aside a certain amount of time each day to spend on inspection.

The following analysis is suggested. Ask yourself:

1. What is my inspection problem? What do I have to do to maintain quality?

2. Shall I assign the inspection in my department to someone as a part- or full-time job.

3. Shall I handle it myself? If so, how much time can I give to it?

4. Shall I try to inspect all work, a certain percentage only, or shall I confine myself to first-piece inspection?

After you have decided these questions, then you must work out your own inspection plan, keeping in mind these points:

1. Set up some definite quality standards. It may be possible to have some actual parts as exhibits of good and bad work.

2. Put these standards in writing whenever possible, and see that everyone affected knows them.

3. Allocate a certain amount of your own time to inspection. If there is an inspection department, you can still afford to spend some time with them.

4. Choose key operations for your own inspection where quality control is most important.

a. Make the rounds of these operations from time to time; change the order of your trips frequently.

b. Select at random 5 or 10 percent of the pieces produced and inspect them carefully.

5. Check the first piece from every new set-up.

6. Use your bulletin board for posting quality records and scrap percentages.

In this way you can still maintain some control over quality even with your other problems.

Checking at End of Day. Just as it is essential to spend the first hour or two seeing that everything gets started right, so it is wise to spend the last hour of the day checking up to see where you stand. No foreman should leave the plant without knowing just where he stands on his schedule. Remember, "eternal vigilance" is the price of success in factory management.

Here are some concrete suggestions:

1. Make a trip around your department and see where each job stands, what has been completed, what you are behind on.

2. Check especially on any rush, special, or back orders to make sure they will be finished on schedule.

3. If you will have to hold up any lot or order because you cannot complete it on time, notify the foreman of the next department so he can rearrange his own work.

4. Be sure that all finished work leaves your department promptly.

5. If there is another shift, be prepared to give the shift foreman a concise picture of just where all work stands, as you turn it over to him.

6. Notify your superior of any unusual difficulties or of any failure on your part to meet your schedule. If there is a planning department, advise it of any delays.

7. If overtime work seems to be necessary, secure approval, arrange for power, heat, passes; most important of all, give the men ample advance notice.

8. Take a look at tomorrow's schedule, so you can get an idea of tomorrow's problems—there may be a new part or operation which you will want to follow up yourself.

9. Perhaps you can get a line on any men who might not report tomorrow because of illness, by talking with them.

Giving Information. Every foreman spends some time giving information to his men, to various departments, such as cost, purchasing, payroll. In many plants, someone is always wanting information from the foreman. Now, actually, this can be a most important part of the foreman's job because giving information is only another form of training or instruction. The point is not to waste time covering the same thing every time.

Suppose you are the only one who knows certain specifications, or what dies are used. It is a mistake to think that that in itself makes you more valuable to the company. Information of that kind belongs in writing.

While it is a part of your job to give information, and you have to spend a certain amount of time doing it, always try to organize the facts into records so that your own time is left free for the really important things. The following practices will help you do this:

1. Have a departmental bulletin board and use it. Put up there every item of interest to those in your department. Change the board frequently.

2. Follow up the new man, talk with him regularly, and tell him the things he needs to know to do his job well.

3. On any new operation or part, make it a point to talk it over in advance with the men on that job, so that they understand exactly what is wanted.

4. If necessary, build up your own departmental records so that facts about specifications, materials, dies, jigs, etc., are on paper and not in your head.

5. Answer every question patiently; be sure the other person understands what you said.

Other points will occur to you. The important thing again is to give information cheerfully, but to avoid going over the same ground time after time.

Trouble Shooting

In every plant, a lot of time and energy are consumed every day

straightening out things that have gone wrong. Some of them, like fleas on a dog, cannot be prevented. On the other hand, some of them are due to failure on the part of someone along the line to do his job right. When a situation like this comes up, the foreman has to drop everything and try to straighten it out. If a foreman finds himself giving almost all his time to trouble shooting, it is a clear indication that something is basically wrong.

Often there may be more than one cause, and none of the causes can be determined by simply "looking over" the job. It becomes necessary to test out several things to see which one may be the cause. The sureness and rapidity with which this is done affects production schedules.

Since every foreman is faced with this problem of trouble shooting, it is worth while to analyze it a little:

1. Try to spot production difficulties before they get out of your department.

2. Stop all work on a product when trouble arises, if necessary. If in doubt, secure approval from your superior.

3. Notify the next foreman.

4. Enlist the aid of functional staff departments, such as the chemical or metallurgical laboratory, at once.

Test out the possible causes by systematic analysis rather than guesswork.

a. Determine the nature of the trouble.

b. Analyze for probable causes. These may lie in one or several of the following fields: Equipment, operation, man, process, material, procedures.

c. Test out the probable causes by elimination. This means taking each cause at a time and proving it does not make the trouble, since when that cause is cut out the trouble still persists.

As a simple illustration of testing by elimination, let us take the shoe factory where it is found the linings do not fit. The foreman notifies the pattern department, which checks and confirms the trouble. From past experience, the pattern department knows that the most probable causes are:

Man Troubles	*Department*
1. Wrong information	Planning
2. Wrong dies	Cutting
3. Not marked right	Cutting
4. Not stitched right	Stitching

By checking up on each one of them and testing it out, each possible cause would be eliminated until the real trouble was run down.

The goal should be to keep trouble to a minimum, by anticipating and supervising. When it is met with, analyze its causes systematically. Too often trouble is due to poor judgment or carelessness. We may have too many interruptions or too many problems to do justice to any of them.

Dealing With Personnel Problems

Every foreman should plan his own day's work so that he has one or two hours a day to deal with personnel problems. Even though there is an industrial relations or personnel department, every foreman should also be his own personnel manager.

How often have you ever sat down and talked with your men, either singly or in groups about the problems in your department? How often have you put some problem up to them as to what should be done? How much do you know about your men anyway, about their personal interests or problems?

If you want to promote good will and understanding in your department, these things will help:

1. Make it a point to talk with every man at least once a week for fifteen minutes. Stop at his bench or machine. Give him a chance to talk about his job and himself. Try to find out if he has anything on his mind.

2. Try out the idea of having a departmental meeting once a month with all your men. Talk over your problems with them, see that they understand them, encourage comments or criticisms. Keep them informed about what is ahead.

3. Handle all grievances promptly.

4. Follow up and encourage new employees.

5. Arrange your work so you spend a certain time at your desk daily. The men will soon realize this, and take that period to come to you with any problem.

Again, the important thing is to recognize that it is a definite part of your job to have some free time to spend on personnel work, every day.

Constructive Thinking

In these changing times, to paraphrase what one of the queens said to Alice, you have to run fast to stay in the same place.

There are only two types of management. The first is going somewhere and knows it. The second is not going anywhere and does not know it. The difference lies in leadership and constructive thinking. Every company should be concerned as to what its competitive position will be next year, three years from now, five years from now.

It is easy to get so accustomed to the same crowded layout, the same old methods, the same equipment, that we develop "blind spots." We no longer look at them critically. They seem to be good enough. Or perhaps, as one executive put it, "After you have sat behind the same desk for twenty years, all you want is to be let alone."

The difficulty is that your competitor may not be so complacent. The company suddenly finds its markets have shifted, or it can no longer make a profit. So it becomes an essential part of management's task to develop and improve methods.

The foreman should recognize his responsibility for improving methods and reducing costs in his department. These objectives do not come from "bright ideas" or inspiration. They come from constructive thinking. They come because somebody sat down and worked out a problem, step by step.

1. If your want to improve methods and reduce costs, you must spend some time constructively thinking about your problems.

2. Take a look at your men, materials, machines, layout, materials handling methods.

3. Ask yourself:

   a. Why do we do it at all?

   b. Why do we do it that way?

   c. What other better ways are there?

   d. What would it cost to change?

   e. What would it save?

4. Select one operation at a time and analyze it as above.

5. Be critical of everything that goes on in your department, from the point of view of constantly trying to do a better job.

Conclusion

At the start we said there was no thought of suggesting that a foreman should work out a rigid daily time schedule for himself. Suppose, however, you were to set up a simple schedule something like this:

Getting Work Started	1 to 2 hours
Systematic Inspection	2 to 3 hours
Personnel Problems	1 to 2 hours
Checking at End of Day	1 to 1½ hours
Paperwork	½ hour
Constructive Thinking	1 hour
Unforeseen Developments	1 hour

That would be your general program. Some days you would have to drop certain items. With such a program to work toward, however, you can be assured that you are using your time most effectively in getting out the day's work. With such a program, not many things will get by you.

MAINTENANCE SERVICES

SELECTION

INSTALLATION

INSPECTION

UPKEEP

ORGANIZATION

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FACTORY MANAGEMENT and MAINTENANCE

McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.

Editorials

MAINTENANCE AS THE EDITORS SEE IT

Return Shipping Containers As Soon as Possible

FROM ONE OF THE LARGEST wire and cable manufacturers comes this plea: "Send back shipping reels, spools, and cases as quickly as possible."

Vast amounts of electric cable and wire are being consumed in new plants or additions to old ones, as well as in ships, airplanes, and many other items that are vital to the defense program in which we are now engaged. Countless reels and spools are required in shipping these conductors to their point of use.

It is easy to understand how, under the stress of emergency conditions, the matter of returning containers can be overlooked. In ordinary times such neglect may be of little moment to anyone except the owner. He wants them back because he doesn't want to tie up more money in expensive containers.

Not so today. Despite the fact that manufacturers of wire and cable are buying and making containers as fast as possible, such an acute shortage has developed that prompt deliveries of materials are threatened. That situation is one that can and should be immediately cleaned up.

Cable reels are not the only items that should be returned promptly to the owner. There are gas cylinders, for example, and other expensive containers.

It takes manpower, materials, and money to replace them and right now all these things are too valuable to the national welfare to permit them to be dissipated in ways that can be avoided.

The Clean, Well-Kept Shop Gets the Subcontracts

IN THE SPRING and early summer, plant house-cleaning is a maintenance *must*. Walls to be painted; floors to be refinished; cracked windowpanes to be replaced; roofs to be checked; lighting fixtures to be cleaned and relamped; yards to be made beautiful, or serviceable for recreational facilities, or both.

Men like to work in a shining, clean shop. They take greater care of well-maintained machines. They're more safety-conscious, healthier. They take more pride in their work, turn out a better product with less spoilage.

In fact, keeping the plant in fine, clean, orderly condition has numerous advantages, no disadvantages. It is surprising, therefore, to see so many factories, especially the smaller shops, that look as if their managers had never even heard of good housekeeping as a vital part of good maintenance and good management. Poor appearance is bound to militate against a shop seeking a defense subcontract.

Cleanliness and order cost so little, and the results are so satisfactory—why not keep the plant house-cleaned all the time?

Fighting Midsummer Heat With Water, Salt, and Air

SPEED AND MORE SPEED is the desire of the day. Not so difficult for men to work fast now, while cool spring breezes blow—but far harder to keep their enthusiasm when a sweltering summer sun is sapping their energy, reducing their efficiency, increasing their irritability.

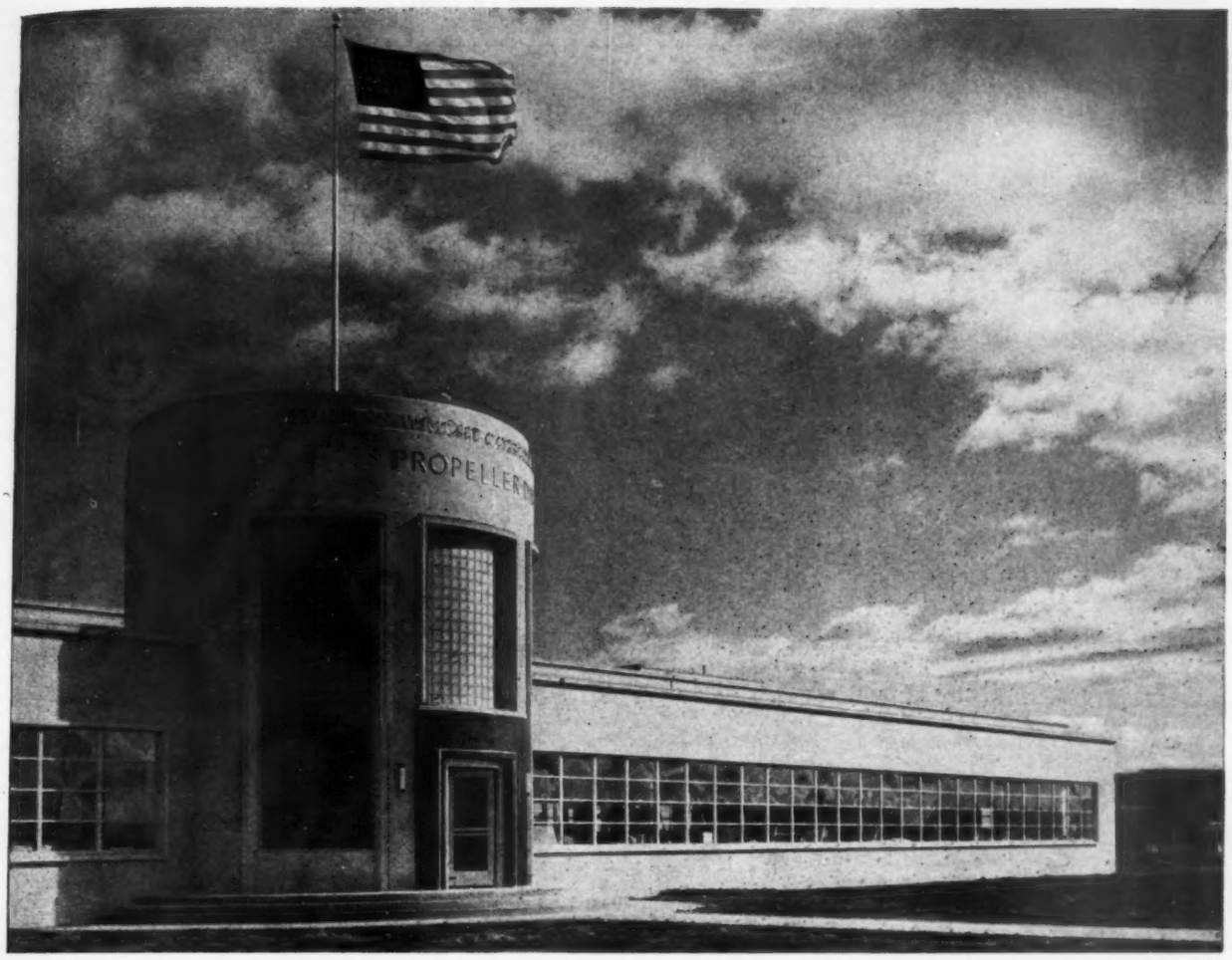
Air conditioned plants make nothing of summer, of course. When weather is man-made, it can be made to man's liking. But there are great numbers of factories that are not air conditioned and whose managers have to use thoughtfulness and ingenuity to keep men comfortable.

Their handiest tool is water—great quantities of water. Hot and cold water for showers, and cool drinking water readily accessible to every person in the plant. Too, water sprayed on the roof of the building will help to keep those on the inside cooler.

And there's another simple thing—salt tablets, placed in dispensers near every water fountain, and men properly induced to help themselves regularly, will prove valuable aids in increasing comfort. They restore to the body minerals that are lost through excessive perspiration, and reduce the tendency to heat sickness and cramps. These tablets have proved themselves under excessively hot manufacturing conditions and are being used more and more under less uncomfortable conditions for relief from ordinary summer discomfort.

Moving air—another of the easy ways to make people feel cooler. Fans and unit coolers will help prevent the breathlessness that comes from still air.

Right now, before summer actually comes and makes the effort of combating heat seem insurmountable, is the time to prepare for the comfort and health of employees.



Limestone, granite, glass block make an attractive entrance to the administration building of Curtiss-Wright propeller division

Designed for Defense Efficiency

From wood block floors to roof monitors, the buildings have been skillfully planned to meet requirements of a plant given over to the production of aircraft propellers

WHEN PRODUCTION FACILITIES at its other plants became inadequate to meet rising demands for its products, Curtiss-Wright Corporation erected, at Caldwell Township, N. J., a self-contained plant having 370,000 square feet of floor space, and consisting of an administration building, factory building, and boiler house. A sewage disposal plant more than large enough for all present needs is now under construction. The plant was designed by Albert Kahn Associated Architects and Engineers, Inc., Detroit.

The administration building, which houses the executive offices, is one story high and approximately 258 feet long by 46 feet wide. To insure maximum quietness it is separated from the main factory building, which is directly behind it, by a space about 50 feet wide. The two buildings are connected by a glass-inclosed passageway.

Exterior walls of the administration building are buff face brick with limestone trim. Steel sash is used throughout. An unusually attractive main entrance was provided by the skillful combination of limestone, granite, and glass block. Throughout this building all ceilings have been sound-insulated by a fiber-base acoustic material.

Floors are covered with a dark-toned, mottled asphalt tile.

Steam heating is used throughout the office and factory areas. In the offices convector-type radiators with thermostat control provide uniform distribution of heat.

Partitions inclosing the office areas are steel, of standardized design that permits maximum flexibility in arrangement. They can easily be taken down and re-erected as changing needs dictate. Finish on the partitions is a dark brown.

The importance of good lighting in the offices as well as the factory areas was clearly recognized and given careful consideration. Final choice of methods resulted in the use of fluorescen lighting in the offices, while corri-

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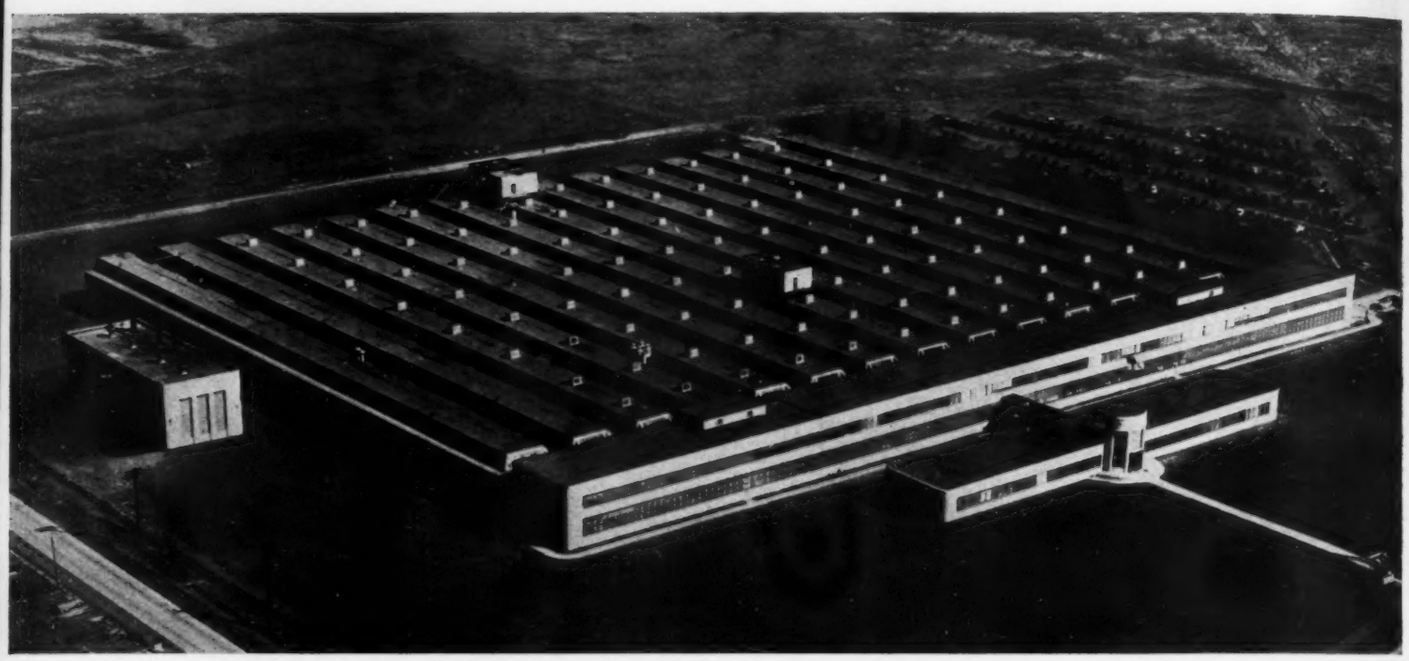


Airview of the Curtiss-Wright propeller plant at Caldwell, N. J. Factory covers 380,000 square feet; took only 96 days to build

Plenty of light—glass walls and monitors for daylight; 300- and 500-watt Mazda lamps (30 and 40 foot-candles) for artificial light

dors and hallways are lighted by Mazda lamps in semi-indirect reflectors.

Modern features are everywhere apparent in the factory building. It is approximately 600 feet long by 527 feet wide, and is of steel frame construction with monitor roof. The front end, nearest the administration building, is two stories high. In this portion some of the shop offices, engineering and drafting departments, and cafeteria are housed on the second floor. Appointments and fittings in these offices are in general the same as or similar to those in the administration building.

The cafeteria is worthy of special mention because of its unusual beauty of design. Since the plant is located in a section that is still largely undeveloped, it was necessary to provide facilities for feeding a large number of employees. Ample space was allotted for this purpose at one end of the second-story section. Walls of the cafeteria are buff-colored glazed tile. The ceiling is faced with a sound-absorbent material. Lighting is by semi-indirect fixtures. Tables and chairs are of attractive, modern-type design that are well in keeping with their surroundings.

On the first floor of the two-story section certain other shop offices are located on one side of the building, while a stockroom, the receiving and shipping departments, and the large first aid room are at the other side. This entire end of the factory building is isolated from the production areas by a brick firewall.

Using All Daylight

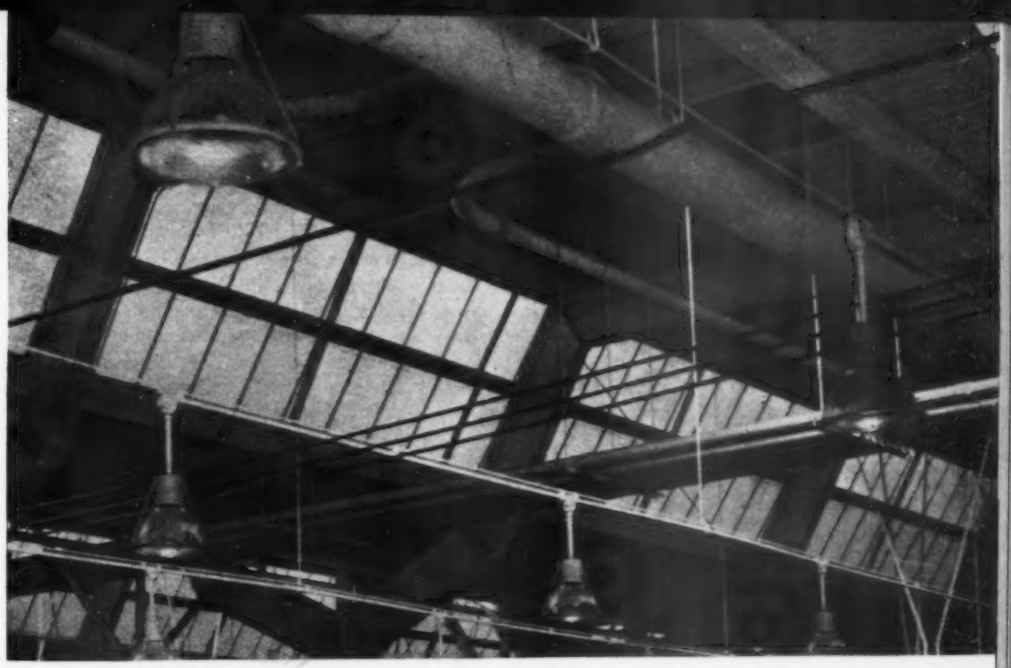
In pursuance of the desire to make maximum use of daylight in the plant, the end and sidewalls of the building are a vast expanse of standard projected steel sash. It is glazed with heat-intercepting glass to reduce the sun's glare and produce more comfortable working conditions in warm weather.

Roof monitors add much to the influx of daylight, while the motor-operated sash in them assist numerous ventilating and exhaust fans in assuring ample ventilation at all times.

The roof comprises a metal deck insulated with a 1-in. layer of cork board, which in turn is protected by a standard tar and gravel built-up waterproof covering.

Wood block floors of the countersunk lug type are used throughout most of the manufacturing areas, while concrete is used in such places as stockrooms, shipping department, first aid room, and toilet and washrooms.

Building columns are spaced on



Bent-beam type of construction was used for the roof monitors. The sheet-metal roof deck is insulated with layer of cork board, protected by a built-up waterproof covering

Plenty of room for deliveries. Overhead sliding doors are motor-operated. Cold air is kept out by a unit heater which is mounted overhead and directly in front of doors

Standard steel sections, finished with either clear or hammered glass, are used for shop office inclosures. Partitions can easily be taken down and re-erected if necessary

MAINTENANCE SERVICES

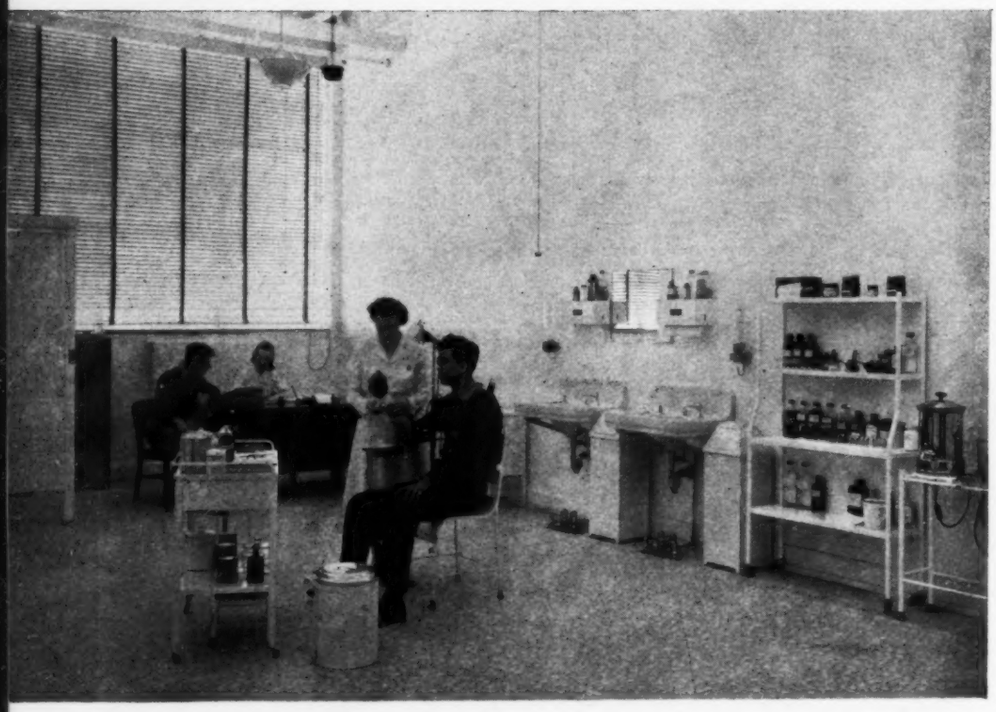
40-ft. by 60-ft. centers. Electric conduits and other service lines are carried overhead in the roof trusses. Branches for serving the various production machines are dropped down alongside convenient building columns and then run under the floor to the equipment.

Lighting in most of the departments is provided by Mazda lamps of 300 or 500 watts rating in clear, prismatic glass reflectors. For the most part these reflectors are mounted 10 feet high and spaced on 10-ft. by 10-ft. centers. With the 300-watt lamps an average intensity of approximately 30 foot-candles is obtained on the working plane. Where the 500-watt lamps are used the intensity is somewhat higher, averaging about 40 foot-candles.

In certain departments fluorescent lighting was considered to be better suited to the requirements. Accordingly these areas are served by two-lamp fixtures rated 200 watts each. They are suspended 10 feet above the floor and are spaced on 10-ft. by 10-ft. centers. Light intensity on the working surfaces is approximately 40 foot-candles.

Following a practice that is becoming widespread, and has much to commend it, toilets and washrooms are suspended from the roof trusses at convenient locations.

In addition, an inclosed mezzanine 420 feet in length and 20 feet wide was built along one side of the building to house the coat racks, wash fountains, and a tiled shower.



Isolated from production areas by a brick firewall, the first-aid room is thoroughly equipped and properly staffed to handle any emergency involving illness or injury

Plenty of Drinking Water

Numerous cabinet-cooler-type fountains located in handy places all over the manufacturing area provide a plentiful supply of cool drinking water.

Inclosures for shop offices and the heat-treating and testing departments are a standard steel partition glazed with clear glass. The design is such that when necessary they can quickly be taken down and re-erected in another location.

Building heating is taken care of by ceiling-mounted unit heaters rated at 200,000 to 500,000 B.t.u., when supplied with steam at 29 pounds pressure per square inch. Thermostat control of these heaters permits easy regulation of the temperature for maximum efficiency and comfort.

Buff glazed-tile walls, acoustic ceiling, semi-indirect light, comfortable chairs make the cafeteria a most pleasant place to relax in

SELECTION • INSTALLATION • INSPECTION • UPKEEP • ORGANIZATION

A Test a Month Keeps Motors Going

Breakdowns are bad in any plant. They're especially bad on mixers where it may take hours to dig the batch out by hand. To sidestep such calamities and prevent stoppages, this plant inspects all motors monthly

P. W. LEHMAN

Chief Engineer

United States Rubber Company

Detroit

WITH 52 SYNCHRONOUS MOTORS in use, ranging in size from 250 to 2,200 horsepower, the matter of proper maintenance to insure continuous operation becomes of supreme importance. We cannot, as we could with smaller motors, shift a spare quickly into place if a breakdown occurs. Stoppages must be avoided, and whatever testing and maintenance work is done, must be done at normally idle periods.

Operating conditions are especially trying to motors in a tire manufacturing plant. Motors usually go bad because of the moisture from steam used in processing, and because carbon black used in compounding gets into the air and, eventually, into the motors. Corrosive action of acids, a problem in some plants, is not nearly so important with us as the two factors just mentioned. Should a motor fail, and the mixing, for example, cease for a prolonged period of time, it would be necessary to cut out the stock in the mill rolls by hand; or, in banbury mixers, to steam the material for six or seven hours to get it out. Periodic

An inspector checks across the slip-rings of a synchronous motor with an insulation resistance meter. Tests like this are made on each motor every month of the year

DATE:

INSULATION RESISTANCE TEST ON MILL ROOM MOTORS 1st OF 36 & 1st OF 38

	STATOR	FIELD	CLUTCH	CONTROL	REMARKS
#8A TUBER MOTOR					
#9A " "					
#10A " " EAST					
#10A " " WEST					
#12A " " EAST					
#12A " " WEST					
#1 TANDEM MOT. EAST					
#1 " " WEST					
#2 " " EAST					
#2 " " WEST					
#38-1 CALENDER MOTOR					
#38-2 " "					
#37-1 " "					
#37-2 " "					
#37-5 " "					

Monthly records of test readings are checked by the superintendent of maintenance; if reading records show a downward trend, steps are taken to clear up the cause

tests and inspection are, therefore, of unusual significance.

A monthly program of test is maintained on the motors and their clutches. Although newer synchronous motors are equipped with cross-line starting and dynamic braking, only three of our motors, of the sixteen for which brakes are needed, are so equipped. Consequently brakes are a vital link in the testing program.

For the motors, the following tests are made a matter of record each month: (1) An insulation resistance test on the stator; (2) the same test on the field; (3) the same test on the control circuit; (4) airgap test with feeler gage.

In addition, bearings are washed out and oil is changed every two years, provided, of course, that the tests do not show the need for change in the meantime.

The monthly feeler-gage test discloses conditions which might hinder effective operation. If the clearance around the stator is not what it should be, bearing trouble is indicated. Should it be found that the rotor has dropped, the bearings are removed, and a new set is inserted to bring proper clearance to the stator.

A low insulation resistance reading on the motors is usually due to moisture, carbon black, or other conditions. And, as in the feeler test, an insulation resistance test is made on each synchronous motor each month.

When the stator reading drops below infinity, the stator is blown out thoroughly with air at 80 pounds pressure per square inch. After the air has been applied for a while, a second reading is taken. Generally the readings show marked improvement. The stator is then gun-sprayed with an air-drying varnish that is not subject to hardening and cracking.

Testing the field, and correcting the difficulties that may be found, is a somewhat more involved matter. In principle, however, the process is the same—an insulation resistance reading, a blow out, and a second reading. There are a large number of field coils on our low-speed motors. Let us assume that the first reading is low, and that air, therefore, is turned on to clean out the fields. If a 2- to 3-hour dose is insufficient to bring the insulation resistance reading up to a safe value, a more detailed job is in order. In this case, one man spins the insulation resistance meter while another blows each field coil individually with the air hose. When the faulty field coil is thus located and cleaned out, the reading comes up to the proper level. Varnish is then applied the same way as with the stator.

This process of analysis takes about 2 hours, and from 14 to 16 hours are allowed for the varnish to dry. While a longer drying time would be helpful, the needs of production will not ordinarily permit a longer period. Even so, by the mere act of varnishing, the reading may frequently be brought up to a sufficient value.

If the Reading Is Low

The methods just described may not remedy the trouble—the reading may still remain low. In this case further steps are required. The field is cut in half and a reading is taken; this process of division continues until the bad section is found. Then the pole and field coil at fault are removed, and new ones are inserted. The reconditioned fields are rung out as a safety measure, and the whole thing is varnished.

Generally, motor burn-outs are prevented by these monthly tests and the application of remedies indicated by them.

In the motors that are equipped with brakes, instead of the dynamic braking provided with the newer synchronous motors, safety regulations require that equipment, rolls primarily, must stop within not more than a specified distance of travel after the safety lever is tripped. This gives some conception of the severe service which the motor brakes must meet. The solenoid brakes and magnetic clutches used on our older motors get insulation resistance tests on brake circuits, clutch circuits, and control circuits to eliminate grounds wherever they appear.

The tests just described are made when the plant is not in operation. The monthly readings are checked by the superintendent of maintenance. If, comparing one month with another, the readings show a downward trend, steps are taken to locate and clear up the cause.

These monthly comparisons of readings are what might be called normal routine procedure. They have, obviously, a diagnostic value—better known as preventive maintenance.

Dust Gets a Holiday in Our Plant

Dust cannot be eliminated, but by air conditioning and vacuum sweeping the air is kept clean enough to avoid damage to products easily injured by abrasive particles

WALTER F. BREEN

Superintendent of Maintenance, Hamilton Watch Company, Lancaster, Pa.

WE HAVE BEEN FIGHTING DUST unceasingly for more than 40 years. It has always been our deadly enemy. In that long period we have tried various methods of eliminating as much dust as possible, and efficiently removing that which couldn't be eliminated. Experience gained in this way, plus the development of efficient suction cleaning and air conditioning equipment, has enabled us to work out a satisfactory, if not perfect, solution of our problems.

Few Dusty Operations

Watchmaking involves a great number of metalworking operations. With the exception of a few, such as buffing, none of these operations produces dust. Therefore, when we speak of dust we refer to the tiny particles that are normally present everywhere in the air.

Inside a building, foot traffic produces a certain amount of dust composed mostly of extremely fine particles of leather and rubber from the wearing down of shoe soles and heels, along with tiny fibers torn from the floor, which in most of the departments in our plant are maple.

A surprising proportion of the particles floating in the air consists of bits of fiber from clothing.

Dust blown in from the outside contains all manner of things—one might say a little bit of everything.

Ordinary dust always contains a certain amount of abrasive material, hence it is obvious that, if dust gets into bearings consisting of a highly polished steel pivot only a few thousandths of an inch in diameter supported in ruby or sapphire jewels, it can do almost irreparable damage in a short time.

Bits of textile fiber are not necessarily destructive of pivots, but they can easily stop a watch, or interfere so seriously with the proper functioning of the parts that accurate timekeeping is impossible. They also tend to suck oil out of the jewels, where it is needed to lubricate the pivots, and let it spread over other parts, where it is a nuisance.

To Walt Breen, 6 feet high and built in proportion, go the responsibility and the credit for keeping the Hamilton Watch Company's big factory and 9 acres of landscaped grounds in shipshape condition. He has been superintendent of maintenance for the past 8 years, and is in charge of an organization of 48 men. Mr. Breen's experience with Hamilton Watch dates back 35 years. His first important job came along several years before World War I when he directed the change-over from steam to electric drive. Away from his job he relaxes by fishing, hunting, and playing golf

Our problem, then, is to keep the air in each department of the plant as free from particles of all kinds as the needs dictate. Good housekeeping is enough to meet this requirement in many departments. In certain other departments, however, air conditioning in addition to the finest quality of housekeeping is required.

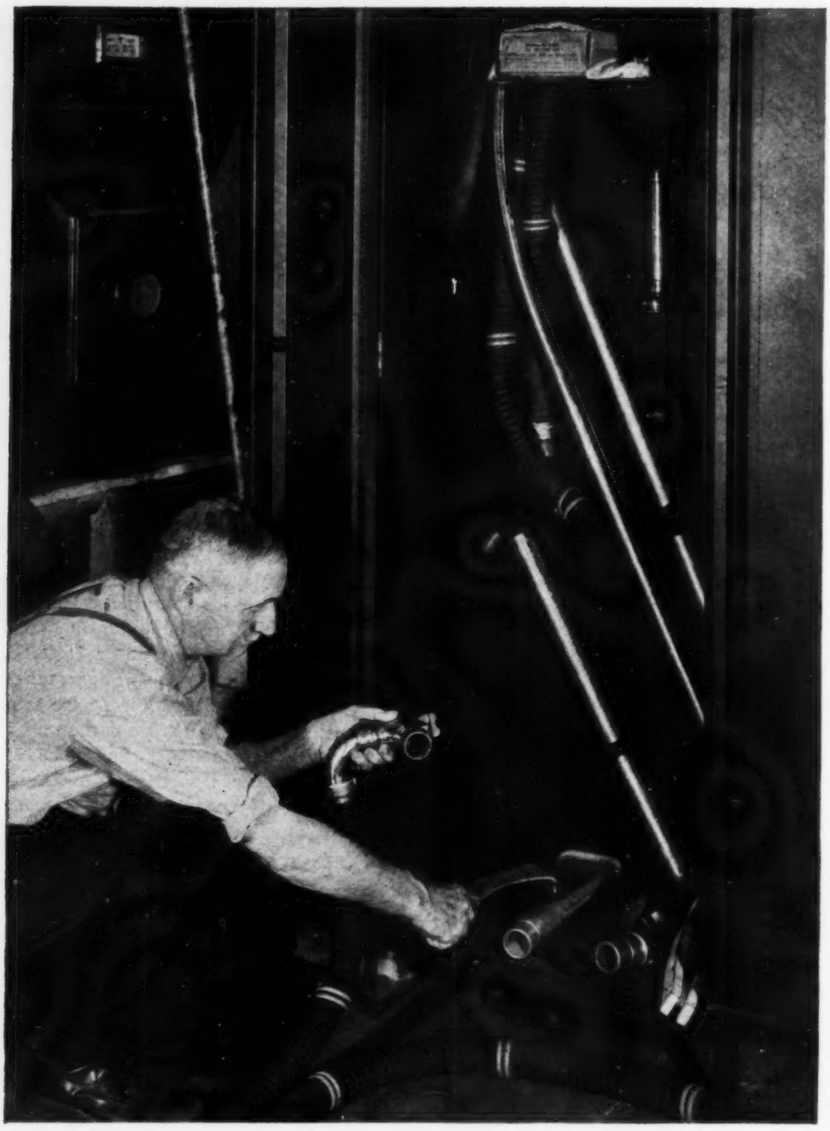
We have 33 major manufacturing departments, which are housed in a four-story building containing about 166,500 square feet of floor space. For many years sweeping and scrubbing were the only means we had of keeping the manufacturing departments and offices clean. With these methods, however, the best job we could do was not good enough. That fact led us to equip the entire plant with a central vacuum or suction cleaning system a little over two years ago.

All Dust Collected

This system consists of a turbine, driven by a 25-hp. motor, which is connected to a large iron tank that serves to collect all dirt drawn into the system. This equipment is located in a room on the first floor, about the center of the plant. Two 6-in. suction pipes branch out in opposite directions from the top of the tank and are the starting point of about 2,500 feet of pipe that traverses the entire plant. These lines become progressively smaller down to a minimum diameter of 2 inches as their distance from the tank increases. They are color-coded by painting them with aluminum, plus a band of light green.

Risers extending up to each floor terminate in outlets spaced and located so that every inch of floor in any part of the plant can be reached with a 50-ft. length of hose. Altogether there are 108 of these outlets.

Ten metal cabinets containing a 50-ft. hose together with suitable nozzles are located at strategic places throughout the plant. When in use the operator



No corner too difficult to get at when the right equipment is at hand. Cabinets with 50 feet of hose, nozzles, extensions are located at ten strategic points in the plant

simply plugs the hose into the nearest suction outlet and sweeps the floor within a 50-ft. radius. Then he switches the hose to another outlet, and so on until the entire area has been thoroughly covered.

All dust and dirt sucked up by the hose are carried back to the tank previously mentioned and deposited in a metal drum, which is emptied at suitable intervals.

It is interesting to note that when the system was first put into operation it picked up an average of 612 pounds of dirt a month. This amount gradually dropped to an appreciably smaller present figure. The explanation seems to be that the high vacuum pulled out the dust and dirt that had accumulated in the cracks, or spaces between the strips, of the maple floors, and could not be removed by sweeping or scrubbing. Since these accumulations have been removed the amount of dirt picked up now represents the quantity that collects each day.

Under our present schedules the floors in all departments are thoroughly vacuum-cleaned every night. In such departments as the machine shop, for example, metal chips and shavings are swept into a pile and shoveled up. Then the floor is cleaned in the same way as the others. We do not have to be careful about sweeping up all chips or small parts with a broom. The suction is so strong that iron washers and other metal parts of considerable size can be picked up with little or no more difficulty than a bit of lint.

In addition to the nightly cleaning, the floors in the offices and certain other departments such as watch assembly are mopped once a week. These floors are covered with asphalt tile. Besides this treatment every floor in the plant, maple and asphalt tile alike, is thoroughly scrubbed every three or four months.

Pipe lines and other overhead surfaces are also vacuum-cleaned at frequent intervals.

The night cleaning crew consists of 11 men and a supervisor. One man is assigned the task of cleaning the floors and dusting the furniture in the offices. The other 10 men handle the factory cleaning. The schedules are arranged so that each man works 6 hours on 4 nights and 8 hours on 2 nights, making a total of 40 hours a week. For example, some of the men come in at 6 p.m. and work until midnight, when they are relieved by another group, which will work until 6 a.m. On the longer shift one group of men will come in at 6 p.m. and work until 2:30, with a half-hour out for lunch, while others may start at 9:30 p.m. and work until 6 a.m.

Gold, Silver, and Jewels

In five or six of our departments precious metals, gold and silver, are worked and handled. Watch jewels are handled in others. There we have the problem of reclaiming the chips and small particles, including jewels, that fall to the floor in spite of all efforts to prevent it. That problem has been solved by interposing a filter between the suction nozzle of the hose and the outlet in the wall. Essentially this filter serves about the same purpose as the dust bag in domestic vacuum cleaners. It comprises a fine-mesh cloth bag housed in a metal tank about 3 feet high, which is mounted on wheels so that it can readily be moved about. All dust and dirt sucked up from the floor are trapped in the filter bag, instead of being carried down to the large tank on the first floor. When the filter is emptied the contents are saved; jewels and other valuable parts are picked out, and the remainder is sent to metal refiners who recover the gold and silver it contains.

Precious metals recovered amount to about $100 a month. Without the use of vacuum cleaning it would be difficult or impossible to recover more than a small fraction of what we now get.

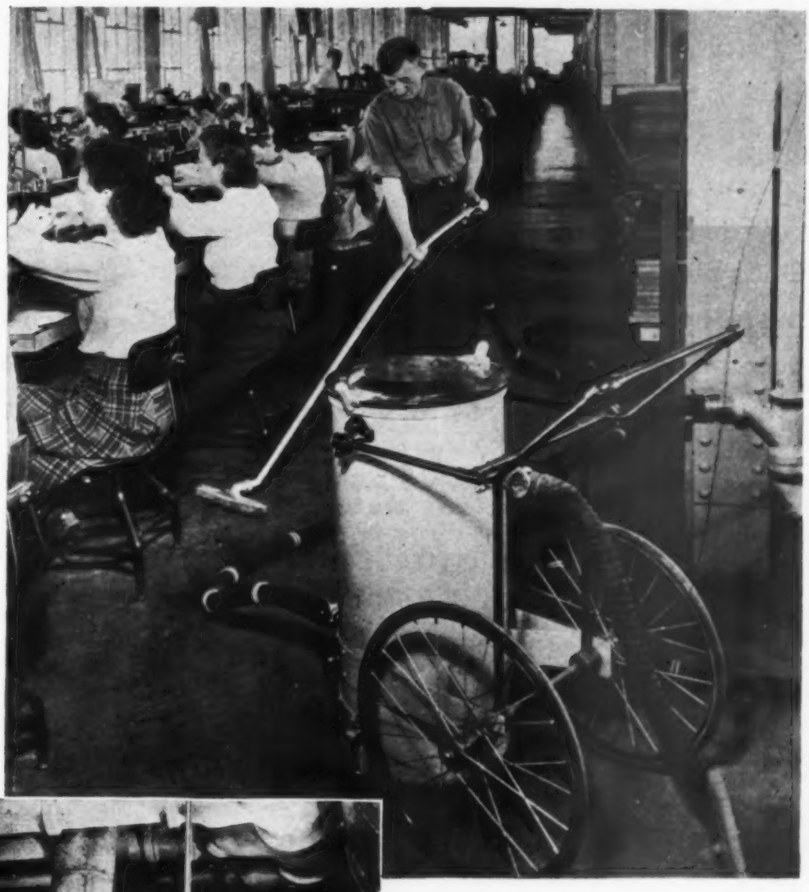
The cleaning methods described in the foregoing suffice to keep 24 of the manufacturing departments, in addition to the general offices, in satisfactory

condition. In 9 other departments, however, the requirements for cleanliness are so exacting that mere removal of dust by vacuum cleaning and scrubbing is not enough. It is necessary to prevent as far as possible any dust from entering these departments. In them such operations as jeweling, dialing, balance spring vibrating, assembling, timing, and casing are conducted. Besides keeping out dust it is necessary to control temperature and relative humidity within close limits. Therefore these departments, which are located on the top floor of the plant and occupy an area of approximately 40,000 square feet, are air conditioned.

All air entering these departments is passed through glass fiber filters. Temperature in the entire area is maintained the year 'round at 76 degrees Fahrenheit, while the relative humidity is kept between 40 and 50 percent. Four refrigerating machines ranging from 25 to 75 tons capacity, with a combined capacity of 165 tons, are required to maintain the desired conditions at all times.

With this combination of vacuum cleaning and air conditioning we feel that we are accomplishing about as much as can be done at present to keep the dust content of the air in our departments within the limits imposed by the nature of our products and the standards that they are required to meet. Certainly these measures have given us a cleaner factory and better working conditions than it was possible to obtain before. Although installation of the two systems involved a considerable expenditure, a sizable amount of the money invested in them is returned annually by the saving of at least $3,500 a year that the vacuum system has enabled us to realize over the cost of the former methods of cleaning.

This saving does not, of course, take into account the longer life and higher quality of our products brought about by carrying on many of the manufacturing, and all of the assembling and testing, operations in a comparatively dust-free atmosphere.



In one department alone this filtering unit reclaims enough jewels every month to supply eighty-five 17-jewel watches

This 25-hp. suction unit with its centrifugal separator is the basement terminus for Hamilton's vacuum cleaning system

Budgeting a Year's Maintenance

Once more the favorite alibi of the can't-budgeteers are busted wide open—this time by two hard-headed cost accountants who have ten years of budgeting experience to back up their theories. First of three installments

EARLE CAZAYOUX and D. J. McNUTT
Libbey-Owens-Ford Glass Company, Toledo

To say that a highly variable group of expenses such as maintenance is budgeted a year in advance, may seem questionable, especially when these expenses are incurred in several plants, and in a great many departments, in which a great variety of work is done. A power house, a melting shop, a grinding and polishing department, a box shop, and many others must be covered in our budget plan. For several years, however, we have made a monthly comparison between standard or budget, and actual, for each item of maintenance expense, and this has served the purpose, as is true of any budget, of keeping these expenses in line with what company history indicates they should be.

Since a number of steps or moves are necessary, both to set the budget standard and to make the monthly comparison of actual expense with the standard, a thumbnail sketch of the plan will serve to indicate its main features.

Every department in each of our plants is budgeted on a basis appropriate to the work done. All maintenance expenses in the power house, for example, are based upon a million pounds of steam produced. Ten years' experience is available, by which each expense item may be related to this base. To set the standard or budget, therefore, it is necessary to know only the number of million pounds of steam produced; a simple multiplication sets the budget figure. By a system of maintenance and work orders the actual maintenance expenses, classified by labor, material, and overhead, are accumulated monthly and posted against the budget figure. A gain or loss on maintenance expense for each department in all plants may therefore be calculated, and appropriate action taken, either to revise budget figures, or to change operating conditions.

Obviously, a great deal of detail forms the basis for this abbreviated description, and, since several plants are involved, a central office control is necessary. This, however, involves no new principle. In a company with a single plant the cost department may be substituted whenever our central office is mentioned, and the procedure followed directly.

Before launching into a complete description of the maintenance budget, perhaps it should be mentioned that a logical classification of departments and of expense accounts is necessary. Each plant is given a number, each department in that plant has a number, and each expense has a number. For example, 6-1586 is the maintenance expense (86) incurred in the grinding and polishing department (15) of plant 6; 6-1540 indicates supplies (40) used by the grinding and polishing department in plant 6; 6-2340 indicates sup-

ACCOUNTING INFORMATION FOR MONTH OF - _____

Sheet #1

6-100	_____	Calendar Days
	_____	Week Days
	_____	Pounds of Steam Produced
	_____	Average B.T.U. per lb. of coal (dry) for month
	_____	Compressor Hours Operated
	_____	Tons of Coal used - (Kentucky or West Virginia)
	_____	Tons of coal used - (Ohio)
6-300	_____	Board Feet of Lumber Checked
	_____	Department Days Worked - 6-A
	_____	Department Days Worked - 6-B
	_____	Board Feet of Lumber Used
	_____	Board Feet of Lumber into Boxes
	_____	Board Feet of Lumber actual waste
6-500	_____	Batches of Regular Glass mixed
	_____	Batches of Black Vitrolite and Trans. Colors Mixed
		Batches of Colored Vitrolite, Color Clear & Aklo Mixed
	_____	Furnace hours operated for Glazing Pittsburgh Pots
	_____	Furnace hours shut down
	_____	Furnace hours operated as Pot Arch
6-1000	_____	Furnaces Cast - .285 - 13/64" Regular
	_____	" " - .301 - 15/64" Regular
	_____	" " - .321 - 1/4" Regular
	_____	" " - .380 - 5/16" Regular
	_____	" " - .430 - 3/8" Regular
	_____	" " - .570 - 1/2" Regular
	_____	" " - .690 - 5/8" Regular

Figure 1. Central office receives an operating report from each department every month

plies used in the maintenance department for purposes of that department only. Such a scheme of classification permits not only the accumulation of experience to use as a basis for a budget, but provides also for the current accumulation of expense for comparison with budget figures.

A ten-year record of maintenance expense by months is available in the central office; this shows both budget and actual figures. In setting the budget for a year in advance, however, a running average of the three most recent years is used. This information is grouped by departments and by class of expense, which, of course, corresponds to the grouping of current actual monthly expenses used in budget comparisons. Our central office (or the cost department in an individual plant) is thus in a position to suggest a future budget standard based upon what has been done in the past.

D. J. McNutt, left, office manager, Rossford plant. Majored in accounting at Ohio State. Two years with Ernst & Ernst were followed by a few months in standards and inventory control at Owens Illinois Glass. Joined Libbey-Owens-Ford cost and control department in 1934. He plays golf, fishes, and boats

F. E. Cazayoux, right, cost controller, general office, Toledo. Born in Louisiana. General accounting at Standard Oil and Toledo Sugar. In 1928 began work on the development of Libbey budget control system. Worked out complete charts of accounts for company in 1932. His hobbies, gardening and the theater

Everyone Is Consulted

To those familiar with the vagaries of maintenance expense, however, it will be apparent that to stop here would give too little consideration to current conditions and would, furthermore, leave the ideas and desires of plant supervision out of the picture.

Before the year's budget is fixed, therefore, the ideas of operating supervision are considered. The central office sends out a recommended budget for each department several days ahead of a meeting that is called to decide what the final budget figures shall be. The cost comptroller, the operating superintendent, the foreman of the department, the office manager, and the plant manager are included in this meeting. Each department is considered in turn. Operating supervision considers the suggested budget in advance and is thus in a position, at the meeting, to suggest betterments and changes, which, if accepted by the central office, are included in the final budget figures.

Since maintenance expenses form a part of our keyman bonus plan, these meetings are fruitful in planning, and present an opportunity for cooperation between the ideas of operating supervision and the ideas of the central office. These ideas are expressed in the historical record of experience and in the knowledge of what is likely to be the operating experience of the company for the year ahead.

In addition, a representative from the engineering department surveys the plant and makes a list of the larger normal and unusual items that occur over a period of years. This survey is checked with the ideas of the maintenance superintendent, and is additional assurance that the plant and equipment will be kept in operating condition. This list is available at the budget meeting. The agreement reached here is worked up into the final budget plan.

All expenses are, of course, covered in the budget, but since this story is concerned with maintenance, only maintenance expenses will be considered; the same procedure, however, applies generally to all expense.

All labor, except maintenance, is based on man-hours. There is, however, such a diversity of jobs and of classes of labor in maintenance that here this expense is budgeted by money value. And, to make operating foremen aware of expense incurred in their departments, and hence to encourage them to supervise completely, maintenance expense is included as a distinct item in all operating departments' budgets. Excesses in one group of expense cannot thus be shifted to another, but each stands out in comparison with a standard, and, if out of line, serves as a basis for appropriate executive action.

The thumbnail description mentioned that the budget allowance in each department is set as a function of some basic operating fact. The basic fact or allowance basis selected in each case is the result of experience. In the power house it is per million pounds of steam produced; in the mixing department it is per ton of batch mixed; in the furnace department it is per furnace cast; in grinding and polishing it is per line hour operated; and so on for the other departments involved.

Then for each of these basic operating facts a standard in money is set. This amount of money is, of course, derived by the central office from the ten years' experience mentioned before. To use a purely fictitious figure, let us say that the basic allowance for repairs and maintenance in the grinding department is $5 for labor and $3 for material per line hour operated. These two sums are the standard or budget rates.

Setting Budget Figures

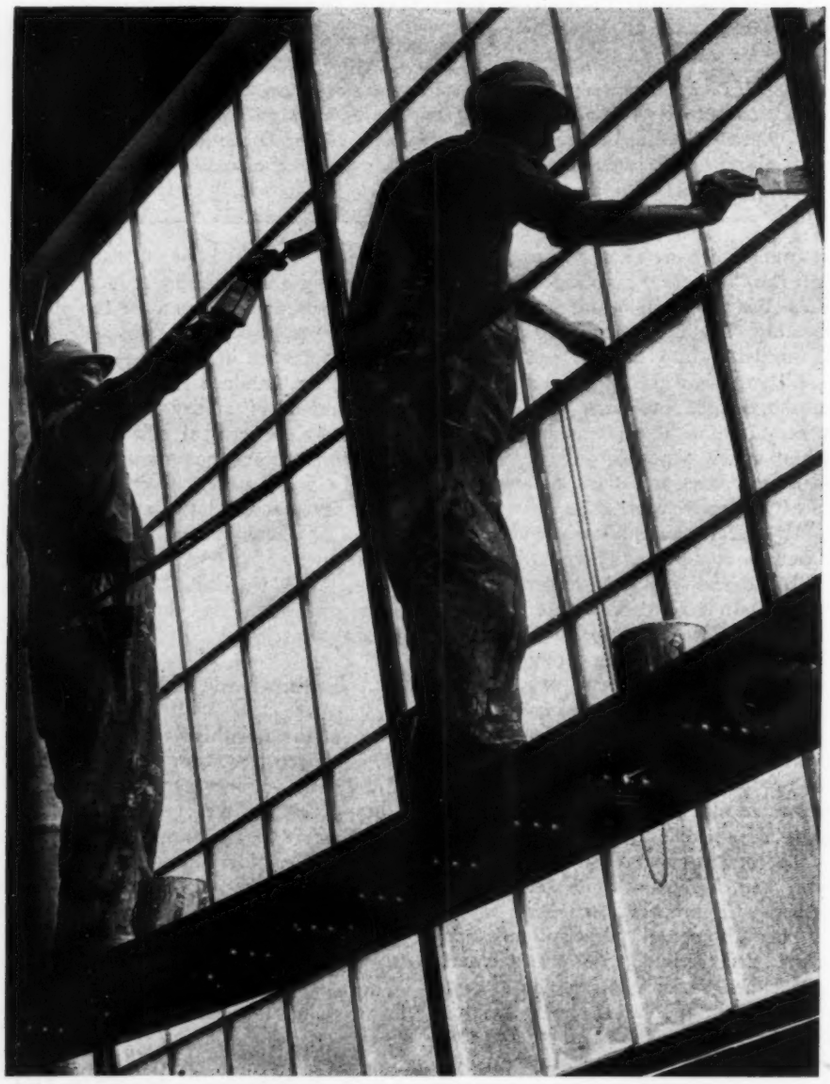
To set the monthly budget, the central office receives from each operating department an operating report (Figure 1), giving the activity for the month. For the grinding department, for example, this report would state, among other facts, the number of line hours operated. A multiplication of this figure by the basic allowances, $5 and $3, would establish the maintenance budget figure, divided into labor and material, for the month in question.

(Second installment of "Budgeting a Year's Maintenance," describing Libbey-Owens-Ford practice in further detail, is scheduled for July.)

Incentives Cut Painting Costs

More money for the men, lower supervision costs, data for painting budgets, accurate records—all because the maintenance department operates on an incentive basis

P. M. MATTHEWS and C. H. BRECHIN
Factory Service Division
Westinghouse Electric & Manufacturing Company
East Pittsburgh



Each job is set up on an individual contract basis. Men pool earnings in proportion to the number of hours they work. Group leaders get a percentage of the bonus earned

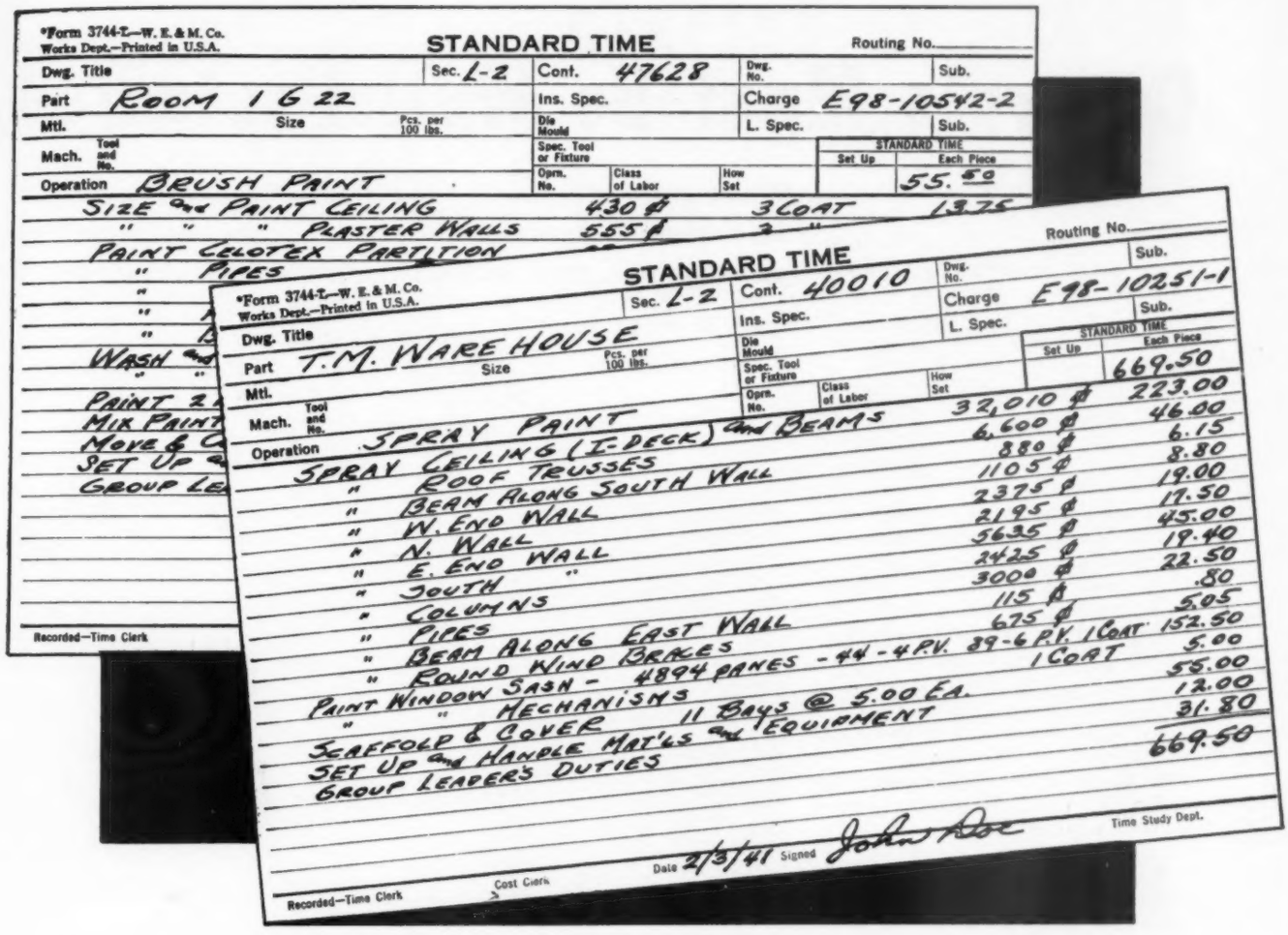
APPLICATION of an incentive plan to painting was one of our first attempts to place the maintenance department on an incentive basis, chiefly because this type of work is more nearly repetitive than most other phases of maintenance. From this angle it provided a groundwork for the solution of more complicated problems.

Most time allowances for painting can be computed on the square foot measurement basis. The few exceptions cover such things as window sash, furniture, and equipment of an intricate nature. The former generally lend themselves to unit measurement on the size basis, and the latter are measured by special values applied to suit individual cases.

In establishing our units of time measurement, we conducted numerous time studies covering practically every phase of painting. This included painting small offices by the brush method, interiors of factory buildings by the spray method, as well as an extensive variety of outside jobs, such as window sash, bridges, viaducts, tanks, outdoor substations, and so on. With all this information we were able to set up a rational system of time measurement, based upon tried and proved tables of details.

Measured by Square Foot

As stated before, square foot measurement is generally used. However, this must be tempered to suit individual cases. For example, it requires more time per square foot to apply the finish coat in brush painting walls than it does to apply a size or starch coat. This is true of the ceiling and upper walls of a room as compared with the lower dado coat. In spraying the interior of a factory building, it requires more time to spray a dirty surface than it does a new or relatively clean surface. Likewise, it requires more time to spray small pipes than flat surfaces. Painting exterior work requires special attention, particularly on sash that involves scraping, wire brushing, reglazing, or new putty. Other factors to be considered are moving materials and



Most allowances for painting are computed on the square foot measurement basis. Exceptions cover such things as window sash, furniture, and intricate equipment. The former lend themselves to unit measurement by size, the latter are treated individually

equipment to and from job; paint mixing; scaffolding; safety precautions for hazardous work, heat, and fumes; weather conditions; kinds of finishes.

Thorough Knowledge Necessary

It can be seen from these factors that a thorough knowledge of the work on the part of the time study man is essential, because, although many data are available, the application of good judgment is a vital factor in applying the proper standards, as well as properly estimating special factors confronted on each job. He must visit each job, thoroughly analyze all steps necessary to complete the order, and include every item in his procedure. This knowledge is gained through close association and experience with the work.

In practice, when a job is received in the department, the group leader and time study man visit the site and determine in detail what is to be done and how it is to be done. The time study man then prepares a time value in allowed hours from his table of details, including any special allowance that may be required. If, during the course of the job, any difficulties or extra work are encountered, the time study man reviews the job, and makes extra allowances.

From the operation standpoint, each group leader has approximately fifteen men under his supervision. He places his men on each job according to the number required for the task at hand. Each job is set up on an individual contract basis, and the men pool their earnings in proportion to the number of hours each devotes to the task. The group leader's time is applied to each contract on a percentage basis, which is commensurate to the allowance of a flat percentage in terms of the allowed hours on each contract. It is, therefore, to the advantage of each man, as well as the group leader, to plan his job so that he can complete it in the shortest possible time.

Plan Has Many Benefits

The benefits gained from the application of the incentive plan are numerous. It has reduced costs of supervision and operation. It has given the men an opportunity to increase their earnings through their individual efforts. It has offered management a sound basis for estimating the costs of painting that are rational and can be controlled from a budget standpoint. It has established accurate records of past performances, and it has presented a method for scheduling painting on a preventive maintenance basis.

Controls Must Be Well Protected

When they must operate under conditions that are harmful or involve dangerous hazards. The problem then is to pick controls and inclosures that match requirements

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General Electric Company
Schenectady

IDEAL LOCATIONS for motor controls are not always available. When they are not, the problem of protecting the mechanisms in some suitable way arises. Last month seven conditions regarded as imposing severe service were discussed. In this article other unfavorable conditions will be taken up.

8. *Exposure to Excessive Oil Vapor.*—Aside from fire and explosion hazards, the presence of excessive oil vapor in the air will often have a bad effect on control equipment. Rubber and certain other organic materials are attacked by oil. Any oily surface tends to collect dust and dirt. If this happens on light pressure contacts, it will cause trouble. If it happens on insulating surfaces, an insulation failure may result. A similar situation is found on many machine tools where cutting and lubricating oils are used so freely that everything soon becomes oily. For these non-hazardous oily locations, control with suitable oil-tight or oil-proof inclosures is available.

9. *Exposure to Salt Air*—On all salt-water ships, on docks and wharves, on some lift bridges, and in numerous plants built on or near tidewater, there is the problem of exposure to salt air. Salt air (particularly salt spray) has a corrosive effect on many metals. In addition, it is worse than ordinary moist air in its effect on insulation; the difference being that salt water is in itself a fairly good conductor, whereas pure water is not.

Control which is located indoors and is well protected from salt spray usually does not require any special construction, even though the location may be near salt water. However, for outdoor and unheated or poorly protected locations, it is advisable to use control in suitable watertight inclosures. These inclosures should be able to withstand exposure to salt spray.

10. *Exposure to Vibration, Shocks, or Tilting*—There are many machines that, by the very nature of their function or design, are subject either to unusual vibration or to shock. Some examples are: power-driven looms, coal pulverizers, locomotives, wood-pulp machines, some metal-cutting machines, and many types of mixers, grinders, and so on. It is often advantageous to mount control equipment on or near such sources of vibration and shock. If the conditions are severe enough to cause contacts to bounce open and arc, or magnets to unseat, or loose parts to vibrate and wear out, then one of the following remedies is necessary. Mount the control on shock-absorbing mounting (rubber or springs), or mount the control away from the vibration, or use equipment designed especially for the condition.

In marine applications, and perhaps a few others, tilting is also a very important consideration. Specifications for shipboard control usually contain some reference to the angle of tilt at which satisfactory operation of magnetic controllers must be maintained. This consideration sometimes requires special design of magnetic devices.

Certain vital controllers for naval vessels even have to operate satisfactorily when subjected to the severe shock conditions of gunfire. This often necessitates very special design.

In an oil refinery good engineering called for 440-volt, explosion-proof full-voltage magnetic switches, lower left, and right, 2,300-volt, oil-immersed full-voltage switches

11. *Exposure to Explosive Dust or Gases*—This refers to the "hazardous locations" which are well defined by the National Electrical Code, Article 500.

Class I locations are those in which flammable volatile liquids, highly flammable gases, mixtures, or other highly flammable substances are manufactured, used, handled, or stored, in other than their original containers.

This class may include such locations as some parts of dry-cleaning and dry-dyeing plants, pyroxylin plastic manufacturing plants, spray-painting establishments, flammable-gas plants, varnish-manufacturing plants, distilleries, rectifying and blending plants producing whiskey and other alcoholic beverage liquors, plants producing industrial alcohol, and establishments or in-

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dustries involving similar hazardous processes or conditions.

Class I locations are further broken down into groups as follows:

Group A—Atmospheres containing acetylene.

Group B—Atmospheres containing hydrogen or manufactured gas.

Group C—Atmospheres containing ethyl ether.

Group D—Atmospheres containing gasoline, petroleum, naphtha, alcohols, acetone, lacquer solvents, natural gas.

Because it covers a large majority of the actual applications, the Group D classification is the only one for which a fairly complete line of controllers is available. There are a few small controllers recommended for Group C locations, and I know of none for Groups A or B. Apparently there has never been much demand for controllers for Group A or B locations.

Two types of control are available for Class I, Group D, locations. The air-break Class I, Group D, equipment is designed to withstand an explosion within its inclosure of a mixture of any of the specified vapors and air, without propagating the explosion outside the inclosure. The oil-immersed Class I, Group D, must have all terminals, connections, and arcing parts immersed to a suitable depth in oil. In general, the air-break type is used for small equipment and auxiliary devices, while the oil-immersed type is more suitable for large or high-voltage controllers. If corrosive gases also are present, oil-immersed type is usually selected.

The following quotation from the National Electrical Code refers to controllers for Class I locations:

"It is recommended that motor controllers be of the remote-control type, with the main contactors located at a point where the hazardous conditions of this class do not prevail. Auxiliary control push-buttons or switches of a type approved for use in explosive atmospheres may then be placed in the most convenient locations."

Class II locations are those in which (1) combustible dust is thrown, or is likely to be thrown, into suspension in the air in sufficient quantities to produce explosive mixtures, or (2) those where it is impracticable to prevent such combustible dust from collecting in such quantities on or in motors, lamps, or other electrical devices that they are likely to become overheated because normal radiation is prevented.

This class may include such locations as some parts of flour mills, feed mills, grain elevators, starch plants, sugar, cocoa and coal pulverizing plants, and establishments or industries with similar hazardous processes or conditions.

Class II is further subdivided into group as follows:

Group E—Atmospheres containing metal dust.

Group F—Atmospheres containing carbon black, or coke dust.

Group G—Atmospheres containing grain dust, etc.

Here also, control manufacturers have fairly well standardized on Class II, Group G, design which is also usually suitable for the other hazardous dust locations. In general, dust-tight inclosures are considered satisfactory, but there are certain design restrictions, such as the type of material which can be used for gaskets, etc.

Class III locations are those in which easily ignitible fibers or materials producing combustible flyings are handled, manufactured, or used, and which are hazardous through such fibers or flyings collecting on or being ignited by arcing contacts, resistors, or lamps.

This class may include locations such as some parts of cotton and other textile mills, combustible-fiber manufacturing plants, cotton gins, clothing manufacturing plants, cotton-seed mills, woodworking plants, and establishments or industries involving similar hazardous processes or conditions.

Class IV locations are those in which easily ignitible combustible fibers are stored or handled (except in rooms where in process of manufacture) and which are hazardous through such fibers being ignited by arcing contacts, resistors, lamps, or similar apparatus.

This class may include warehouses in which are stored or handled combustible fibers, such as cotton (including cotton linters and cotton waste), sisal or henequen, istle, jute, hemp, tow, cocoa fiber, oakum, baled waste, kapok, Spanish moss, excelsior, and other similar readily ignitible fibers.

Ordinary dust-tight control inclosures are usually satisfactory for Class III and IV locations, provided they do not overheat under the heavy blanket of dust and lint that may accumulate, particularly in Class III. Class II inclosures are also suitable for Class III and IV locations.

12. *Exposure to Weather or Dripping Water*—It is quite often a definite economic advantage, as well as an operating convenience, to be able to mount control right out in the weather. Almost all large plants, and many small ones, have some applications where outdoor types of control can be used to advantage. A few applications where control equipment is quite commonly mounted outdoors are: oil-well pumps, water pumps, oil refineries, shipboard (deck machinery), electric-sign, traffic-light, and street-light controls.

To be suitable for outdoor use, control must be inclosed tightly enough to exclude the most driving rain. Its exterior surface must withstand the corrosive and weathering effects of rain, wind, and sun. In hot climates, the summer sun may cause the equipment to run dangerously hot. All these factors should be considered in selecting control for outdoor service. In general, inclosures that are classified as watertight are considered most suitable for outdoor use. However, there are a number of applications, some involving large equipment, where so-called weatherproof equipment has been used successfully. Weatherproof inclosures do not necessarily exclude all water, but they keep it away from vital parts. Sometimes modifications, such as drip shields or hoods, can be added to indoor-type inclosures to make them sufficiently weatherproof.

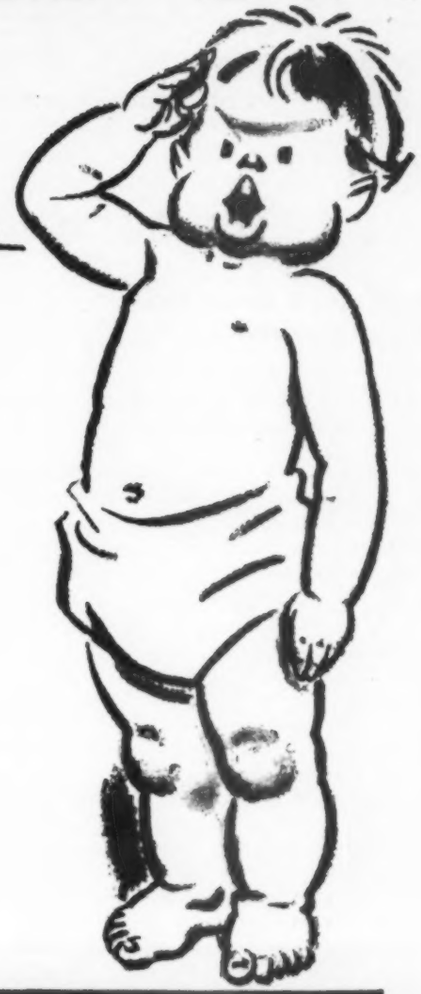
Mounting control outdoors has the advantage of a saving in installation cost; either the cost of building a shelter or of providing additional wiring for remote mounting in existing buildings. Among its disadvantages must be noted that it is more difficult to inspect and service than standard types of control.

There are also a number of indoor locations where control has to be protected against dripping water. This is not so difficult as protecting against driving rain. Almost any good corrosion-resisting inclosure provided with a drip shield should be satisfactory. If the atmosphere is extremely moist, proper precautions, as previously discussed, should be taken.

From the above brief discussion, it can be seen that the selection of the proper type of control for any unusual service condition often involves the consideration of a number of factors. In addition to the application engineering involved, there are the requirements of the various electrical codes (local, state, and national) to be considered. Sometimes a particular requirement of a certain fire-insurance underwriter must also be considered. The Bureau of Mines (a division of the U. S. Department of Commerce) also has its own specifications for controllers in hazardous mine locations.

ORDER OF THE DAY

KEEP THEM YOUNG WITH HYATTS!



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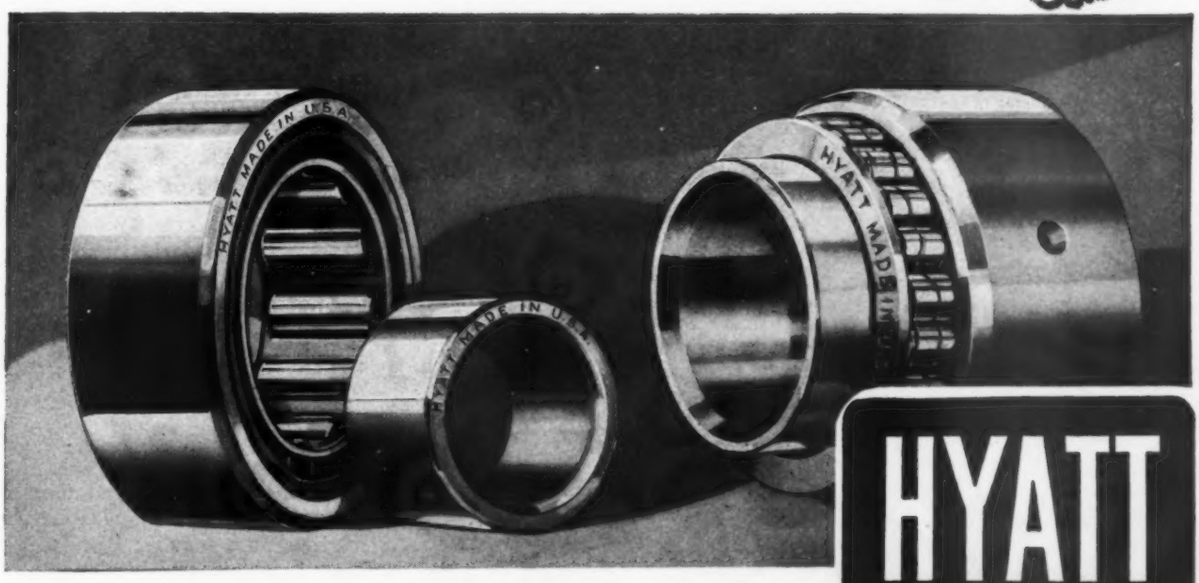

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QUIET

Maintenance Service Shorts

Readers are invited to contribute brief illustrated articles reporting out-of-the ordinary maintenance accomplishments. Accepted articles will be paid for

ELECTRICAL UTILIZATION

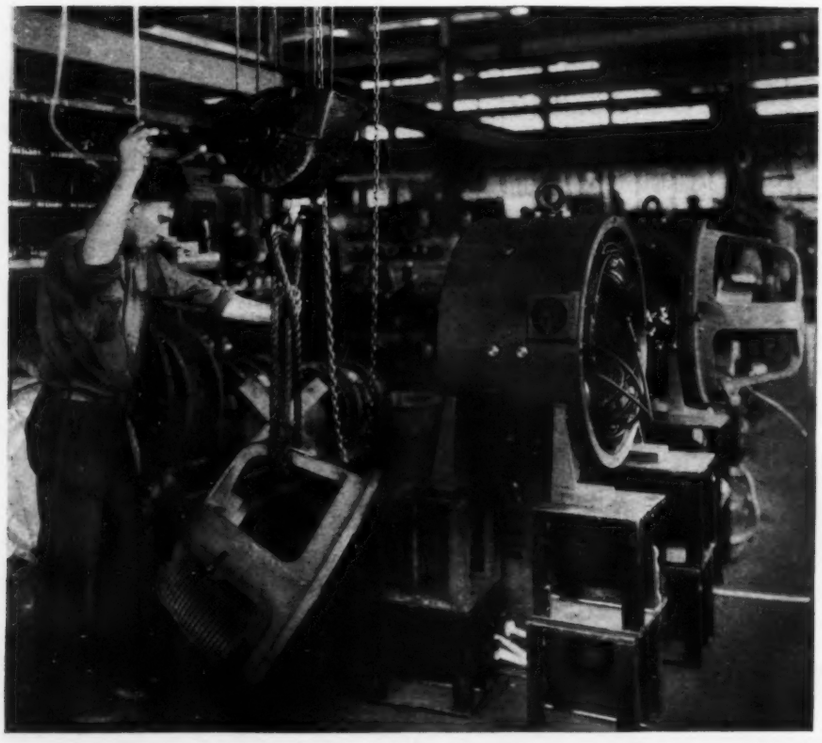
Simple Steel Blocks Make Strong Supports

SOURCE
Reliance Electric & Engineering Company, Cleveland

How to handle different-sized motors so as to permit assemblers to work freely on all sides, and reduce shifting about to a minimum, was a problem until the idea of supporting the motors on steel blocks was hit upon.

Motors weighing from a few hundred pounds to as much as 5 or 6 tons are now placed atop the steel blocks shown in the illustration. As a rule, medium-sized motors are assembled on a single layer of blocks, while two layers are needed for small motors.

These steel blocks are 12 inches square and are made from 12x12-in. I-beams sawed in 12-in. lengths. Light angles are welded in the four corners of each section of I-beam to give it uniform rigidity and facilitate handling. The blocks are light enough to be lifted and arranged safely and easily by hand, and at the same time are strong enough to bear any load that is likely to be placed on them.



Steel blocks made by reinforcing short lengths of I-beam at the corners are handy supports for motors during assembly. The motor shown weighs approximately 2,500 pounds

•

They Forgot That Series Motors Will Run Away

DANA GIBSON, *Toledo, Ohio*

It is common knowledge that series-wound d.c. motors will literally run away if not coupled to a load. An electrician and his helper forgot, however, that compound-wound motors with the shunt field disconnected become series motors.

They had been assigned to reconnect a 75-hp. compound-wound shear motor that had been returned from the repair shop. It was housed in a small, sheet-iron inclosure with one door and no windows, located in the middle of a steel scrap yard. The motor had not been coupled to the shear; therefore the first step was to determine the rotation, also whether the fields were bucking or boosting. This matter had been overlooked in the shop. Since this 250-volt motor was quite bulky it was necessary because of space limitations for the electrician to climb over it in order to reach the leads on the opposite side.

After operating the motor as a straight shunt machine the electrician connected it for series operation, with the shunt field disconnected, and told his helper to throw the switch. Rated speed of the motor was 900 revolutions per minute, but in an instant it had reached an estimated speed of 3,000 revolutions, where anything might happen. Meanwhile the electrician, pale-faced and speechless, was hemmed in by iron walls on one side and a motor he feared to climb over, on the other.

The helper hurriedly pulled the switch, drawing a 5-in. arc, and the armature slowly came to rest. A thorough examination showed that it was still in one piece. Inspection of the commutator brought from the electrician a grin and the remark: "We learn something new every day. Today we learned a new way to clean commutator slots."

He also learned that a series-connected motor should always be tied to some mechanical load, and never be allowed to run light under full voltage.

•

Infra-Red Gives Bearings Tight Press Fit

SOURCE
The Timken Roller Bearing Company Canton, Ohio

A method has been developed for heating bearing cones preparatory to assembling them on shafts where a tight press fit is required.

This device consists of three trays about 4 feet square, tiered 12 inches apart. The middle tray is of Pyrex glass, while the top and bottom trays each carry seven 250-watt special infra-red bulbs. The reflectors on these special bulbs are gold-plated.

Bearing cones are not taken out of

Two views of fluorescent lamp office installation in Standard Oil Co., Elizabeth, N. J. Wheeler 4619 "Day-Lux" Luminaires with Jefferson Electric Ballasts. Oscar Vogelbach, engineer; E. J. White Co., contractors; Graybar Electric Co., Inc., distributors,—all of Newark, N. J.

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JEFFERSON ELECTRIC FLUORESCENT LAMP BALLASTS

the boxes, but are stacked in their containers. About 20 minutes are required to heat a bearing up to a maximum of 155 degrees Fahrenheit. The infrared rays penetrate the boxes, heat the steel, but leave the cardboard relatively cold.

When this method of heating is used, it is not necessary to wash off the protective coating which is put on the bearings at the time of packing.

•

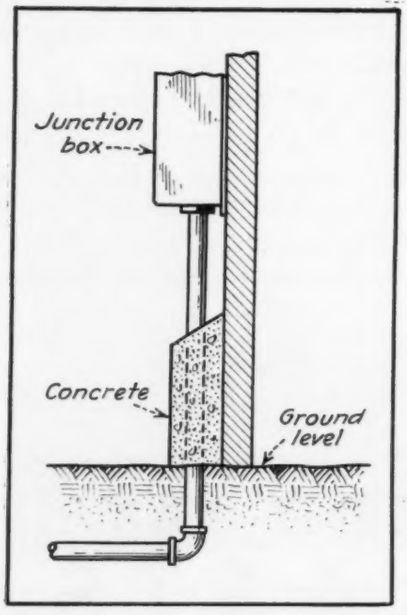
For Long Life, Protect Conduit at Ground Line

GILBERT LINDGREN, *Electrical Foreman*
Hudson Valley Fuel Corporation
Troy, N. Y.

From the standpoint of corrosion the weakest spot in underground conduits is at the points where they enter and leave the ground. At these points corrosion is very rapid.

Conduits that are buried in sand or concrete will last much longer if they are protected by concrete to a height of a foot or more above the ground.

The top of the form should be given a decided slope in order to insure quick shedding of water.



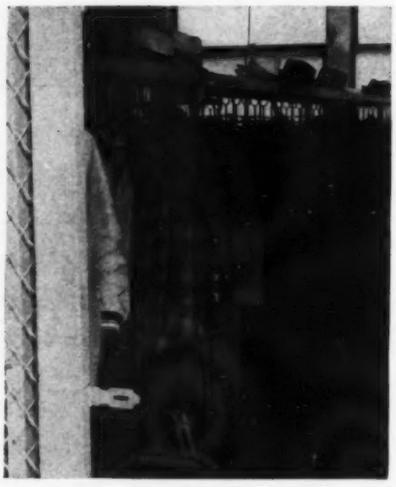
BUILDINGS, SERVICES, MAINTENANCE

Accommodating Many, Coat Racks Take Little Space

ROBERT A. SHAW, *Detroit, Mich.*

With so many new men coming into plants to work on defense orders, locker facilities are likely to be inadequate in many cases, at least for some little time. Where space is limited, it may have to remain inadequate and substitutes more economical of space must be devised.

One of these space savers, or temporary expedients, whichever the case may be, is this coat rack. Made of T-bar and flat steel stock, welded together, it is assembled in sections approximately 4 feet long and 6 feet in over-all height. Sections can be bolted together to prevent units from getting out of line. A cross-member maintaining stability of



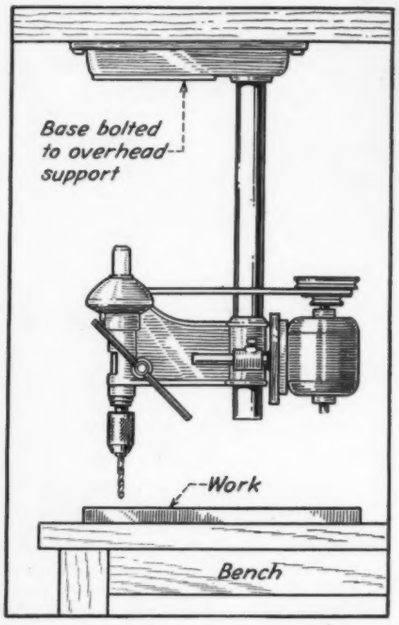
the frame is used as a shoe shelf. The top serves for hat and lunch storage.

Special hangers fabricated from No. 6 wire have the hanger loop brazed closed when the hanger is put in place, so that hangers cannot be removed from the rack. Individual hangers are spaced seven inches apart.

Since the racks are of metal, and open, they are easy to keep clear and free from vermin. The 7-in. spacing between hangers is sufficient to allow air to circulate through the clothing. On a rainy day, clothes have a chance to dry out before they are put on again at end of the shift.

Clothing hung on these racks is not under lock and key, and some protection must be provided. This can be done by setting up the racks in a room that can be kept locked except when shifts are changing. A foreman or assistant foreman can be detailed to lock and unlock the room at proper times and remain there while shifts are changing.

•



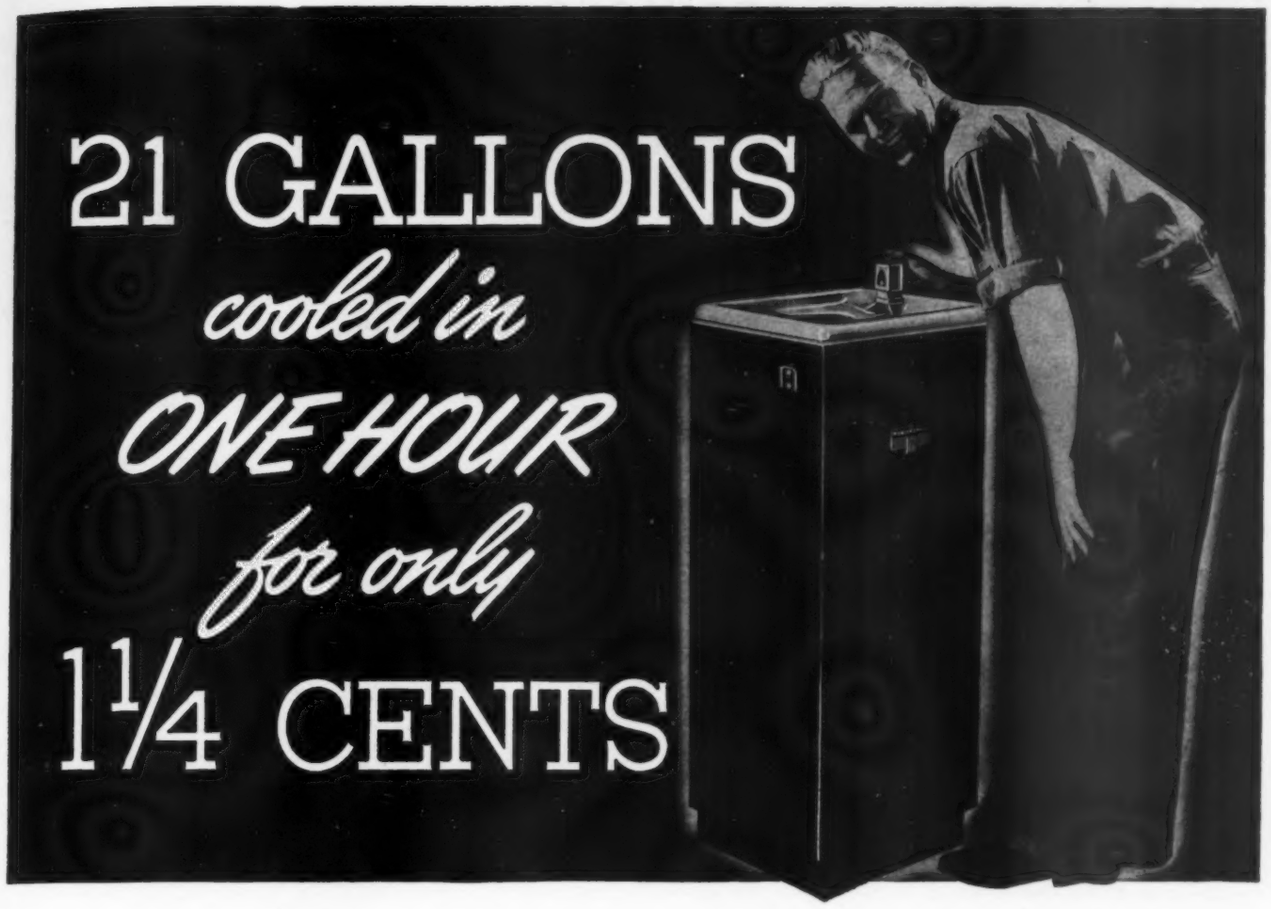
The base of the drill is bolted to overhead beams or to a framework attached to them

Ceiling-Mounted Drillpress Handles Larger Work

J. J. REICH
Reich-Huntington Iron Works
Huntington, W. Va.

The illustration shows a simple method of adapting bench-type drillpresses to handle much larger work than would ordinarily be possible. It will be noticed that no special parts other than four lag bolts are needed to mount the drill in this way.

If the ceiling is low enough the base of the drill can be bolted directly to the overhead beams. When the ceiling is too high for such mounting either



WITH WESTINGHOUSE WATER COOLERS

These figures apply to heavy-duty models. They are based on cooling water for bubbler service from 80 degrees to 50 degrees at a three-cent electric rate. Under these conditions 119 people an hour can be served in the average heavy manufacturing plant. For cup service these models will cool approximately 453 four-ounce drinks for one cent.

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Westinghouse coolers are meeting the pace of all-out defense schedules in many key plants. Among these are the Glenn L. Martin Company, Radford Ordnance Works, Springfield Armory, White Motor Company, American Steel Foundries, Carnegie-Illinois Steel Corporation.

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a longer column may be used with the drill or a suitable framework to which the drill may be attached can be suspended from the beams.

Aside from increasing the size of parts that can be handled, this method of mounting a drillpress has the added advantage of keeping the bench or table clear and making it possible for layout work to be done and the jobs drilled without moving them from one bench to another.

•

Portable Compressors Keep Mill Running

SOURCE
Chicopee Mfg. Corp. of N. H.
Manchester, N. H.

When a 2300-volt, 335-hp. synchronous motor burned out early in May, this company rushed portable air compressors into service and thereby kept a weave room running.

The big motor drives an air compressor that delivers 3,000 cubic feet per minute. The air is needed to humidify the weave room and as soon as the air went off, yarn breakage began to go up. It was obvious that the room would have to be shut down.

All this happened late one Thursday night. On Friday morning the compressors were ordered from a Boston concern which rents them out for construction jobs. They came from Concord, N. H., from Boston, Worcester, and New Haven. Valves and fittings were picked up all over New England.

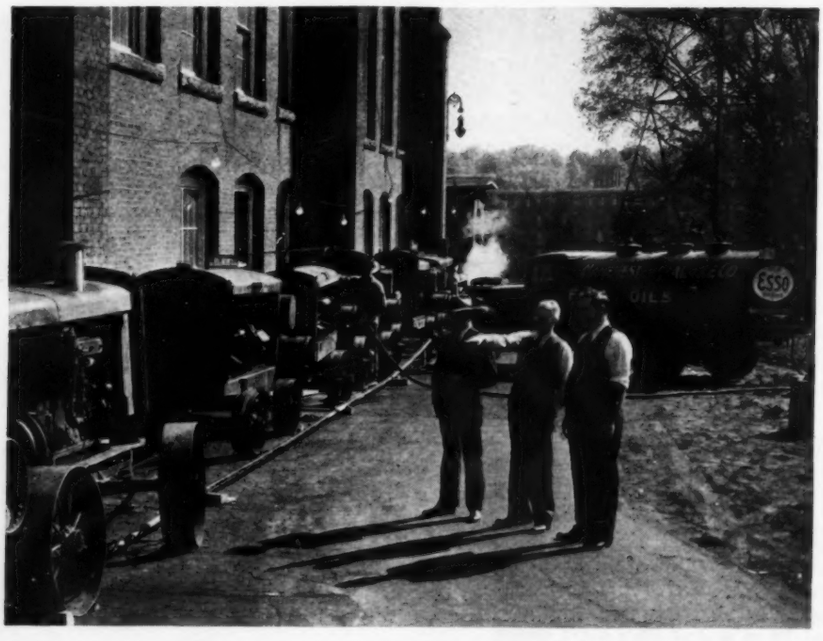
Use of an atomic hydrogen arc welder to repair broken tools and dies in the toolroom of the Bridgeport, Conn., plant, enables Underwood-Elliott-Fisher Company to save more than $6,000 a year, plus time formerly taken up in waiting for new parts

On Saturday the portable compressors were delivering 2,000 cubic feet of air, and a small compressor that provides high-pressure air for cleaning had been added to the line.

Thus in two days' time the mill was operating okay. One very real benefit has been the effect on employee morale. Operators saw how hard the company was trying to keep the mill running, and appreciated its efforts.

Work simplification sidelight: The local fuel company suggested putting on a tank and a sump for the gasoline, but the mill superintendent asked instead for a tank truck with a hose.

Floodlights were later installed to replace the temporary lights strung over the compressors.



Portable machines pinch-hit for big air compressor, helped to keep weave room running

•

Paintbrush With Scraper Saves Time

FRANK V. FAULHABER, *Brooklyn, N. Y.*

One enterprising maintenance man who is regularly assigned to inside painting jobs around our plant decided to save time and energy by making for himself a combination paintbrush and scraper. This was done by cutting a slit about 2½ inches long in the end of a paintbrush handle and inserting in it a thin strip of 14-gage steel. Two holes for rivets were drilled in the brush handle and the steel strip. The end of the steel was then ground down to provide a scraping edge.

The advantage of this combination is that the painter always has his scraper at hand to clean off dirt and smooth down rough surfaces.

- ✓ **Skin Softened Hands Do More and Better Work**
- ✓ **No Parched Skin Stiffness to Lessen Finger Dexterity**
- ✓ **Less Likelihood of Dermatitis and Lost Time**
- ✓ **Less Work for the Nurse and the Doctor**
- ✓ **More Production per Man-Hour**

CLEAN HANDS send workmen home smiling. But washing with powerful detergents, grit—and strong alkali soaps, or sneaking a wash-off with solvents are hardly good business. Did you ever watch a workman, at the start of a shift, start to work a little flexibility into stiff, clubby fingers. A parched dry skin (from harsh chemical washing) is a substantial cause. Think it over.

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Selecting the Type of Welded Joint

C. M. TAYLOR
Vice-President, The Lincoln Electric Company, Cleveland

THE WELDED JOINT, being a vital factor not only in the strength, rigidity, and other physical qualities of any welded product or structure, but also in its cost of manufacture, fabrication, or construction, it is important that the joint be carefully selected with consideration of important factors.

There are three factors which govern selection of the type of joint. These are:

1. The load and its characteristics; that is, whether the load is in tension or compression, and whether bending, fatigue, or impact stresses are present in any combination.

2. The manner in which the load is applied; that is, whether load application is steady, variable, or sudden.

3. The cost of the joint preparation and welding.

Obviously the joint to select is the one which meets the load requirements, and costs the least.

Aid in selecting the best joint for given service conditions and cost is provided in the following detailed discussion of the principal types of joints.

Butt joints are of several types, each having a number of variations. However, the general classification lists butt joints as square, vee bevel, U, and J.

Figure 1. Square butt joint, suitable for all usual loads, requires full and complete fusion, particularly when load is of fatigue or intermittent nature. The base metal of this type of joint must be good weldable steel, since a large portion of the base metal is melted during welding. The thickness of the plate on which the square butt joint is used is generally ⅜ inch or lighter when welded with metal electrode, and ¾ inch or lighter with carbon electrode, although this type of joint has been used on other plate sizes. Preparation for welding this joint is simple, requiring only a matching of the edges of the plate, separated by a distance dependent upon the plate thickness. Because of the simple preparation, the square butt joint is low in cost.

Figure 2. Single-vee butt joint, suitable for all usual load conditions. It is generally used with plate thickness considerably greater than the square butt joint—⅜ inch or heavier—although its use on thinner plate is not unusual. Preparation is more costly than the square butt joint, and more electrode is used in welding.

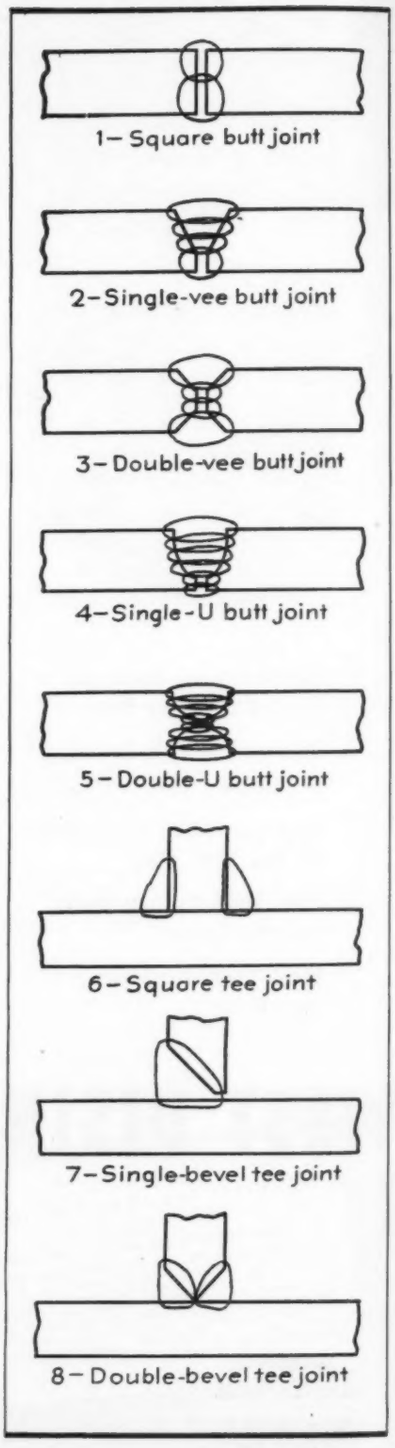
Figure 3. Double-vee butt joint, suitable for all usual load conditions. It is used for plates of greater thickness than the single-vee and for work that can be welded from both sides. Cost of preparation for welding is higher than for single-vee butt joint, but double-vee requires approximately half as much electrode. Cost of machining should be weighed against the cost of welding and the joint selection made accordingly.

Figure 4. Single-U butt joint, suitable for all usual load conditions and used for work of the highest quality. Replaces single- or double-vee joint for joining plates ½ to ¾ inch thick, although it is also used on heavier plate. For plates of this thickness, single or double-vee would require a considerable amount of weld metal. Machining the plates to a single U reduces the amount of weld metal needed but increases machining costs. The joint is welded from one side, except for a single bead that is put in last on opposite side from the U.

Figure 5. Double-U butt joint, suitable for all load conditions and used for welding heavy plates—¾ inch and thicker—where the welding can be done from both sides. This joint requires less weld metal than the single U, but costs more to machine. Choice between double U and double-vee should be made by comparing the machining and welding costs of the two, then selecting the joint which costs less.

Figure 6. Square tee joint, corresponds to the square butt joint in that no machining of plates is required. The square tee is used for all ordinary plate thicknesses, principally for loads

(Continued on page 108)



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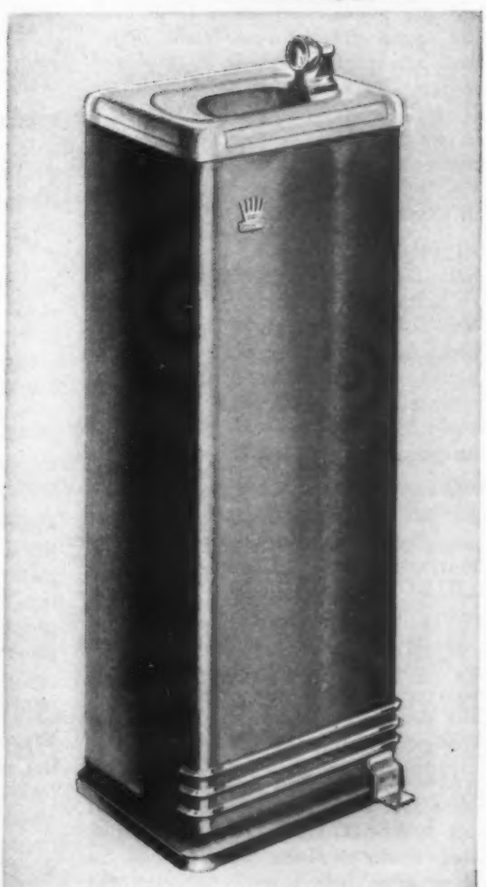

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(FM-6)

Selecting the Type of Welded Joint

(Continued from page 106)

which place the welds in longitudinal shear. For severe impact or heavy transverse loads, the non-uniform stress distribution of the joint should be kept in mind and the stress intensity of the application duly considered. The square tee requires more weld metal and therefore has higher welding cost than other types of tee joints.

Figure 7. Single-bevel tee joint, suitable for much more severe loads than the square tee, because of its better distribution of stress. It is employed in most instances, for welding plates ½ inch or thinner, in work that can be welded from one side only. While more costly to machine than the plain tee, the single-bevel tee joint is lower in electrode costs.

Figure 8. Double-bevel tee joint, suitable for heavy loads in longitudinal or transverse shear in joining heavy plate, where welding can be done from both sides. Double-bevel is somewhat higher than single-bevel tee joint in machining cost, but has lower electrode cost than some other types, such as plain tee.

Figure 9. Single-J tee joint, suitable for severe loads. Although it may be used for plates of usual size, it is generally applied to plates 1 inch and heavier. The welding is done from one side only. However, it is advisable to put in a final finish bead on the side opposite the J. Although somewhat more costly to machine than the single-vee, the single-J tee joint is lower in electrode costs.

Figure 10. Double-J tee joint, suitable for exceedingly severe loads of all types in heavy plate—1½ inch and heavier—where welding can be done from both sides. Although the machining costs for the double-J tee are higher than for other types of tee joints, less electrode is required, consequently the cost per joint is reduced.

Figure 11. Single-fillet lap joint, frequently used. It has the advantage of requiring practically no machining to fit the edges of the plate. When fatigue or impact loads are encountered, stress distribution should be carefully studied. Where loading is not too severe, the single-fillet lap joint is suitable for welding plate of all thickness.

Figure 12. Double-fillet lap joint, suitable for load conditions much more severe than can be met by the single-fillet lap joint. In general, the two fillets should be full size, although one fillet may be smaller than the other in some instances. Because of its lower cost, the double-fillet lap joint is widely used. For extremely severe loads, the butt joint, Figures 1 to 5, should be used.

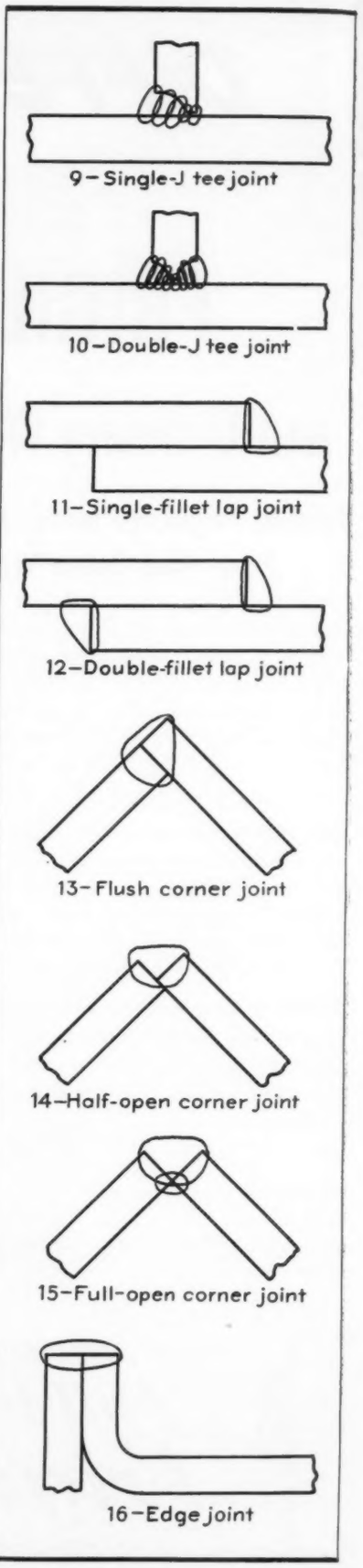
Figure 13. Flush corner joint, suitable where loads are not severe, or in welding plate 12-gage and lighter. Although permissible for use on heavier plates, care should be taken that loading is not excessive.

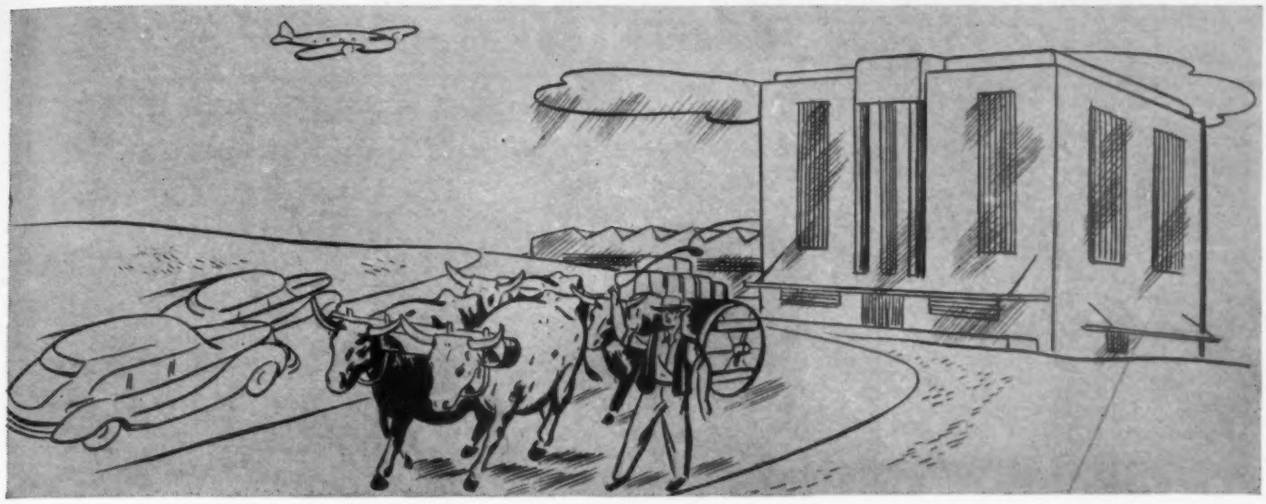
Figure 14. Half-open corner joint, suitable for loads where fatigue or impact is not severe. This joint is generally used on plates heavier than 12-gage, where the welding can be done from one side only. The "shouldering" effect of this type of joint aids welding by reducing the tendency to burn through the plates at the corner.

Figure 15. Full-open corner joint, suitable for severe loads in welding plate of all thicknesses where the welding can be done from both sides. When properly made, this joint is shaped to provide good stress distribution, thus permitting its application to fatigue or impact loads of all types.

Figure 16. Edge joint, used in joining plates ¼ inch or thinner for light loads. Careful consideration must be given to the load conditions, especially impact and fatigue, as this type of joint is not suitable for severe loads.

Keeping in mind the suitability to load requirements and production economy of the various welded joints, will prove an efficient guide in selecting the type that is best for its particular application. Employing the proper joint for the job, and making it with modern welding equipment, electrodes, and procedure, will assure the inherent benefits of high structural quality and economy in the arc-welding process.





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and you CAN *"get by" cleaning your plant with brushes and brooms*

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Invincibles are the lightest, most easily handled of all heavy duty industrial cleaners. They deliver more power per pound and more years of uninterrupted service. This is not surprising when you consider that for 35 years we have done nothing else but eat, sleep, and dream heavy duty vacuum cleaning. We *should* know more about it.

In addition to reducing your cleaning costs Invincibles get your plant *really clean,* a statement that does not apply to brushes, brooms, or any other method that simply involves pushing the dirt around. The fly-dust simply goes into the air and resettles. For a *perfectly* clean plant you *must* use vacuum.

An Invincible engineer is at your service to demonstrate how you can have a cleaner plant at lower cost. Your inquiry will be promptly acknowledged. Write to Invincible Vacuum Cleaner Mfg. Company, 440 Davis Street, Dover, Ohio.

HOW TO *STOP* ACCIDENTS

Over 10% of industry's compensated occupational injuries are caused from falls to the same level, and over 8% are caused from falls to a different level.

Many of these accidents are caused from slipping on oily or wet floors and stairways. This hazard can be removed. TEN-LOX Anti-Slip Stair Treads and Floor Tile offer permanent safety underfoot wherever required.

TEN-LOX is made of long-wearing materials with abrasive grits that penetrate clear through the entire thickness of the casting. It is furnished in a wide variety of sizes, and treads are furnished with or without nosings.

TEN-LOX is always highly efficient and particularly so where wet and oily conditions exist. Tests have shown the gripping power to be even greater where surfaces are covered with oil and grease.

TEN-LOX is approved by the Underwriters' Laboratories. It is easily installed, easy to clean and keep clean, and always looks attractive. TEN-LOX is dependable, permanent, economical and accepted. We invite your inquiry.

Wherever they Walk use

TEN-LOX

REG. U. S. PAT. OFF

A PRODUCT OF

THE NATIONAL BRONZE & ALUMINUM FOUNDRY CO.

Specialties Division

E. 88th and Laisy Ave., Cleveland, Ohio

You Want to Know

more about the items mentioned on this page. Letters to the addresses given will bring information

• AN IMMERSION PROCESS for zinc and its alloys produces a thin coating of jet black finish in one to five minutes. Particularly valuable for nameplate finishing where recesses are to be blackened; for blackening etchings on tools, rules, and squares. Can also be applied to zinc-plated or hot-galvanized surfaces; and to stainless steel and alloys, nickel silver and other metals when in contact with a piece of zinc. The Enthone Co., 442 Elm St., New Haven, Conn.

MAIN FEATURES of this tiny tubular lamp are its special filament and built-in silver reflector which together throw a flood of concentrated light wherever you want it. Useful in narrow places hard to light and on machines to illuminate scales, micrometer readings, special operations. Wabash Appliance Corp., 335 Carroll St., Brooklyn, N. Y.

• FIBER GLASS adhesive tape, made principally for electrical applications, is applied like any industrial tape and comes in rolls 40 inches wide. May be cut to any width. Industrial Tape Corp., New Brunswick, N. J.

• AN INJECTION-MOLDED glass and ground mica compound is said to have better electrical characteristics than porcelain and comparable mechanical strength; to be impervious to oil, water, and gas; and to be unaffected by sudden temperature changes. General Electric Co., Plastics Department, Pittsfield, Mass.

• A STAPLE PULLER makes quick work of removing large and small staples from wood posts and the like so that they can be re-used. Seward's, Rossville, Ga.

• "INDUSTRIAL RELATIONS in a Defense Economy" and "Interchanging Ideas Between Management and Employees" are two booklets offered by the American Management Association, 330 West 42d St., New York. 75c and 50c respectively.

• MAGNETIC FLASHLIGHT spots that nut or screw that slid from your hand into a dark corner and picks it up for you with a magnet on the tip of the Lucite extension through which the light curves. Emeloid Co., 289 Laurel Ave., Arlington, N. J.

• WAYS AND MEANS of providing safe working conditions to aid defense output are discussed in four pamphlets: "Safeguarding Manpower for Greater Production," "The Worker's Safety and National Defense," "Protecting Plant Manpower," "Conserving Manpower in Defense Industries." United States Department of Labor, Division of Labor Standards, Washington, D. C.

• EXTINGUISHING POWDER gives off a blanket of vapor that smothers out magnesium and other metallic fires flaring up in the plant or started by incendiary bombs. It is said to have no abrasive action on machinery. Pyrene Mfg. Co., Newark, N. J.

• COMPANIES facing defense expansion will find help in six pamphlets on current practice: "The Organization of a Personnel Department," "The Employment Division," "Reorganization of Hour Schedules," "Job Classification and Evaluation," "Policies in the Adjustment of Wage Rates," "Basic Training Policies." 20c each, $1 for set. Industrial Relations Section, Princeton University, Princeton, N. J.

• PLANT NOTICES, production schedules, safety posters, special exhibits can now be mounted on a removable bulletin board which fits into a metal case fitted with a glass door. For wall mounting, it measures 20 inches wide, 37 inches high, 1¾ inches deep. The Boyer-Campbell Co., 6540 Antoine St., Detroit.

• THREE BOOKLETS, "Psychological Aids in the Selection of Workers," "Principles and Methods of Industrial Training," and "Putting Job Rating to Work," have been made available at 75c each by the American Management Association, 330 West 42d St., New York.

• ONE WAY of stimulating employee suggestions is through the use of wall cabinets located at strategic points. This one has a receptacle for ideas and a space above it for a weekly message requesting suggestions on various problems. Morton Mfg. Co., 5105-43 West Lake St., Chicago.

• "PROTECTIVE Construction" outlines methods, plans, procedures that should

P-Q* Higher

• MAINTENANCE . . . LOWER
• BEARING FAILURES . . . NONE

PHOTO SHOWS
TYE SPOTTING
OUTHWARK PRESS

SINCE THE SWITCH TO

SUN H. D. LUBRICANTS

For years the matter of properly lubricating bearings of forming and stamping presses had been a troublesome problem in a large automotive body plant. Bearing failures, because of grease solidifying in the feed lines, were accepted as unavoidable. Grease pushed out of the bearings . . . much of it was wasted. Presses and floors needed frequent cleaning.

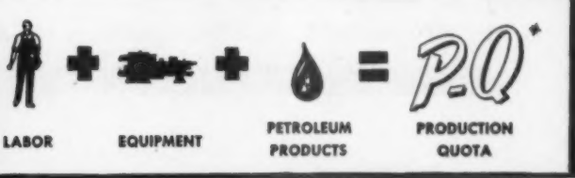
Then came the change to one SUN Heavy Duty Lubricant for all of the presses. Trouble stopped . . . and the upward swing in P-Q* (Production Quota) started! Now after 18 months of trouble-free operation the record is . . .

- NOT A SINGLE BEARING FAILURE
- GREASE LINES NEVER CLOGGED
- WASTE HAS BEEN ELIMINATED
- GREASE CONSUMPTION CUT 50%
- PRESSES NEVER DOWN BECAUSE OF LUBRICATION TROUBLE

What's the Production Quota of your plant? Is it up where it belongs? Perhaps the higher P-Q of SUN Industrial Lubricants can help you speed up your production. Write today for your copy of "P-Q—Your Key To Increased Production."

SUN OIL COMPANY—Philadelphia

Sponsors of the Sunoco News Voice of the Air—Lowell Thomas



SUN OILS

PETROLEUM PRODUCTS FOR ALL INDUSTRIES

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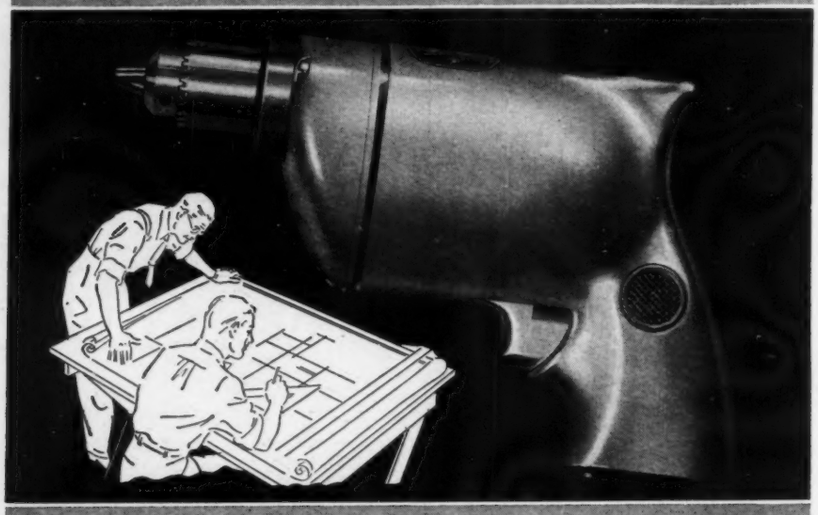
★ Van Dorn Drills



Engineered for Industry

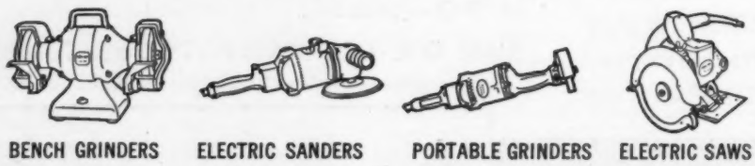
VAN DORN DRILL leadership is not solely due to a line of dependable Drills. Equally important is the fact that industry recognizes Van Dorn is alert to industry's needs—and builds Drills that are *engineered to meet them!* That's why Van Dorn Drills are continually being improved with new designs, newer and more efficient mechanical features and more sturdy materials. Result is Drills with increased power, smaller size and lighter weight. Drills whose longer service and reliability is backed by one of the Oldest Names in the electric tool industry. And you can choose from a *most complete* Drill line—30 Drill models, ranging from the tiny 3/16" Hornet for faster production, to the giant 1½" Heavy Duty for brute boring. Ask your jobber to demonstrate Van Dorn Drills engineered for *your* needs—or wire Van Dorn Electric Tools, 719 Joppa Road, Towson, Maryland.

"Van Dorn"

(DIV. OF BLACK & DECKER MFG. CO.)

THE "RED HEADED" PORTABLE ELECTRIC TOOLS

Other Van Dorn Tools to Speed Up Work



BENCH GRINDERS ELECTRIC SANDERS PORTABLE GRINDERS ELECTRIC SAWS

be considered in the building of bomb-proof and other protective structures. The information is based on foreign reports and on tests conducted in the United States. 25c. United States Government Printing Office, Washington, D. C.

• STANDARDS for allowable concentrations of carbon monoxide, hydrogen, sulfide, carbon disulfide, and benzene have been set up for protection of workers in industry. The four booklets are available at 20c each. American Standards Association, 29 West 39th St., New York.

• BLUE GLASS for welding helmets is said to protect workers' eyes against harmful ultra-violet rays given off in bronze and aluminum welding, to reduce injurious infra-red ray transmission, and yet to permit welders to see more clearly than through average blue glass colors. Willson Products, Inc., Reading, Pa.

RESISTANCE TO OILS and solvents is claimed for this rubber-like glove which protects the hands against such skin irritants. Also useful in the handling of metal parts that must be protected against tarnish. Four sizes—10½ to 18 inches long. Resistoflex Corp., Belleville, N. J.

• CHECKING RINSES used in industrial processes is done in short order by an instrument whose main dial indicates in direct terms the amount of carry-over or contamination present in the rinse. Also checks industrial solution concentrations. Industrial Instruments, Inc., 156 Culver Ave., Jersey City, N. J.

• IF YOUR LEAD ROOFS FAIL to contract after expansion, you will be interested in a new lead roofing that features high creep resistance; is thin rolled, light in weight, acid resistant, and non-staining. Alloying elements add to its strength. Revere Copper & Brass, Inc., 230 Park Ave., New York.

• SNOW WHITE is the color of a non-staining asbestos-yarn packing that the food and drug industries, paper and pulp mills, ceramic plants, and others may want to use on apparatus handling liquids that must be kept free from discoloration and contamination. Greene, Tweed & Co., 101 Park Ave., New York.

How the Performance of **ONE** Mahon Oven Sold **TWO MORE** to the Same Manufacturer

In 1939, The Stout Sign Company, of St. Louis, Mo., sought a speedier and more economical means of drying the finish on their product. Following a thorough analysis of their problem, Mahon engineers installed a Mahon Gas-Fired, Box-Type Oven, with a temperature range up to 400° F. The oven was designed to re-circulate heated air and to exhaust volatile gases and was fitted with automatic safety and temperature controls.

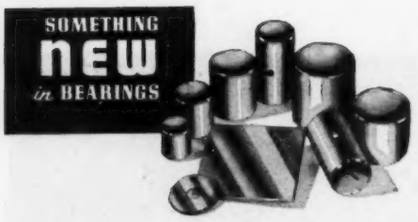
A close check was kept of the service and savings effected. So well did the performance record show up, two similar Mahon ovens now have been added to the finishing line in their fine, new, modern plant, recently completed.

If YOU have a drying or baking problem, Mahon experts will advise you just as carefully in regard to the size and type of oven and equipment which will operate most efficiently and economically for YOUR PRODUCT.

THE R. C. MAHON COMPANY • DETROIT • CHICAGO

Designers and Manufacturers of Complete Finishing Systems, Metal Cleaning Machines, Rust Proofing Machines, Hydro-Filter Spray Booths, Drying and Baking Ovens, Dust Collectors, Filtered Air Supply Systems and Many Other Units of Special Production Equipment.

MAHON



Pre-Cast Bearing

Bronze on Steel

Here is a new and unusual bearing material developed to meet the present day demands of equipment manufacturers. The bronze alloy—S.A.E. 64—in powder form, is permanently bonded to strip steel, producing a thin wall laminated type of bearing. Thus you gain the bearing qualities of bronze plus the strength of steel.

While *Pre-Cast Bearing* BRONZE ON STEEL was primarily developed for bearings, it has already found many other important applications in industry. It is an ideal metal for washers, stampings or plates. Available either as a finished bearing or part, or in rolls up to 400 feet in length.

It will pay you to investigate the possibilities of this new development. A request, on your business letterhead, will bring you complete details plus a sample bearing.

Write for this . . . .

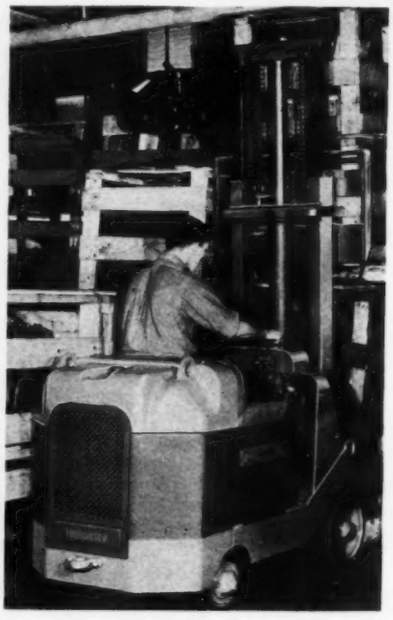
Free folder that describes *Pre-Cast Bearing* BRONZE ON STEEL in detail . . . fully illustrated . . . containing authentic technical data. Write today.

JOHNSON BRONZE
512 SOUTH MILL STREET
NEW CASTLE, PA.

What's New in Equipment

Lift Truck

Companion model to LT-40, the lift truck model LT-44 Towmotor is capable of lifting 4,000 lb. at 15 in. from the carriage. Has a 44-in. wheelbase, with a turning radius of only 72 in.; overall width is 35 in., and overall length 74 in. (without



forks). Equipped with low, medium, and high telescopic lifts up to 132 in. Special purpose attachments available and interchangeable. Powered by 27½-hp. 4-cylinder gas engine, equipped with degaser and governor, it is said to travel at speeds from 1 to 10 miles an hour. Has two forward and two reverse speeds. Will lift and stack its rated load accurately to heights of 7, 9, and 11 ft. at the rate of approximately 40 ft. per minute. Towmotor Co., Cleveland.

Fluorescent Testing Instruments

Daco Fluortest Junior is designed for testing any fluorescent fixture from 15 to 100 watts, either a.c. or d.c., simply by removing the lamp and plugging in an adaptor in both lamp sockets. Instrument reading indicates line voltage, lamp operating voltage, condition of the reactor, compensator, and starters. Daco Fluortest Senior is equipped to test lamps and all auxiliaries before assembly in fixture, or after removal from fixture. Models are available for testing airplane fluorescent equipment. It is claimed that these instruments locate defects in fluorescent fixtures in less than a minute. Dayton Acme Co., Cincinnati.

Direct Fired Air Heater

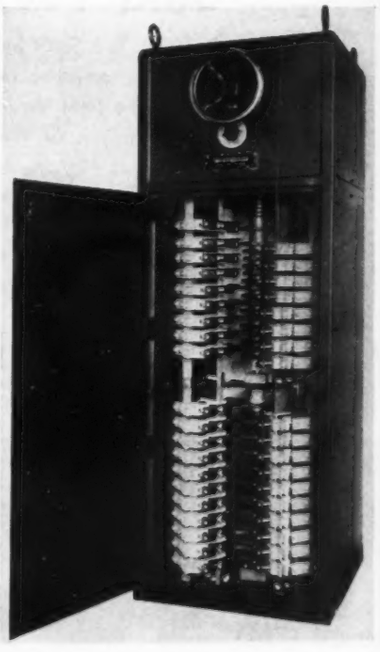
Floor-type, direct-fired heater with an output of 1,500,000 B.t.u. per hour. Tubular economizer serves to reduce the flue gas temperature to lowest practicable limit. Can be fired with oil or gas, and converted from one to the other at any time. Equipped with safety controls that shut off fuel in event of flame or power failure. Operation automatically controlled. Discharge nozzles can be adjusted to discharge air in any direction. Heater is designed to throw heat as far as 200 ft. and can be used in conjunction with a duct system. Dravo Corp., Pittsburgh.

Packaging Materials

Corroflex is a waterproof, flexible corrugated packing material with criss-cross indentations, and an outer covering of kraft. Available in all-purpose weight in rolls from 6 to 72 in. and in sheets cut to size. Sherman Paper Products Corp., Newton Upper Falls, Mass.

Secondary Controller

For use with polyphase wound-rotor motors on fan, pump, and similar drives, this SC controller provides either 13 or 20 points of control by varying external resistance in motor secondary winding. Enclosed in a steel cabinet. Unit has cam-actuated contactors arranged for sequential

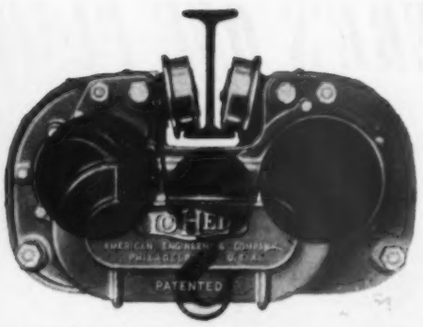


AMERICAN ENGINEERING COMPANY

The Lo-Hed Hoist Is Applicable To Any Monorail System
There's A Balanced Lo-Hed Electric Hoist For Every Purpose

OTHER A-E-CO PRODUCTS: TAYLOR STOKERS, MARINE DECK AUXILIARIES, HELE-SHAW FLUID POWER

Look in your Classified Telephone Directory under "A-E-CO LO-HED HOISTS" for your nearest representative.



BALANCE MAKES A DIFFERENCE IN HOISTS

LO-HED, the *Balanced* Hoist. For years men have noticed that they could spot a Lo-Hed electric hoist immediately. "It looks different", they said. Well, it is different. Unlike any other hoist, the Lo-Hed is built right around the beam, with the motor and drum on opposite sides of the beam, hook suspended directly below beam center. The unique construction of the Lo-Hed hoist achieves low headroom, gives you an efficient spur-gear drive, maximum accessibility, and a sturdy construction noted for its low upkeep. A Lo-Hed hoist is worth a few dollars more. Buy a Lo-Hed for low operating and maintenance costs. Write for Lo-Hed catalog today.

LOOK AT THE BALANCED LO-HED!

It Costs Less To Operate—All gears are efficient stub-tooth spur gears running in a sealed oil bath . . . gear shafts and trolley wheels are equipped with heavy-duty ball or roller bearings.

It Costs Less To Maintain—Sturdy construction . . . seldom, if ever, requires removal from rail . . . covers of controller, motor, drum and gearing are easily removed.

It's Safe—Factor of safety of over 5 at full capacity . . . 100% Positive Automatic Stop when load reaches upper limit . . . Automatic Holding Brake prevents load from drifting when current is shut off . . . short, strong shafts minimize torsional stresses.

It's Protected—Controller is fire, dust and moisture proof . . . motor totally enclosed . . . gearing sealed in . . . motor and drum covered by easily removable covers.

AMERICAN ENGINEERING COMPANY
2426 Aramingo Avenue, Philadelphia

☐ Please send me your complete catalog of LO-HED HOISTS.
☐ Ask your representative to get in touch with me promptly.

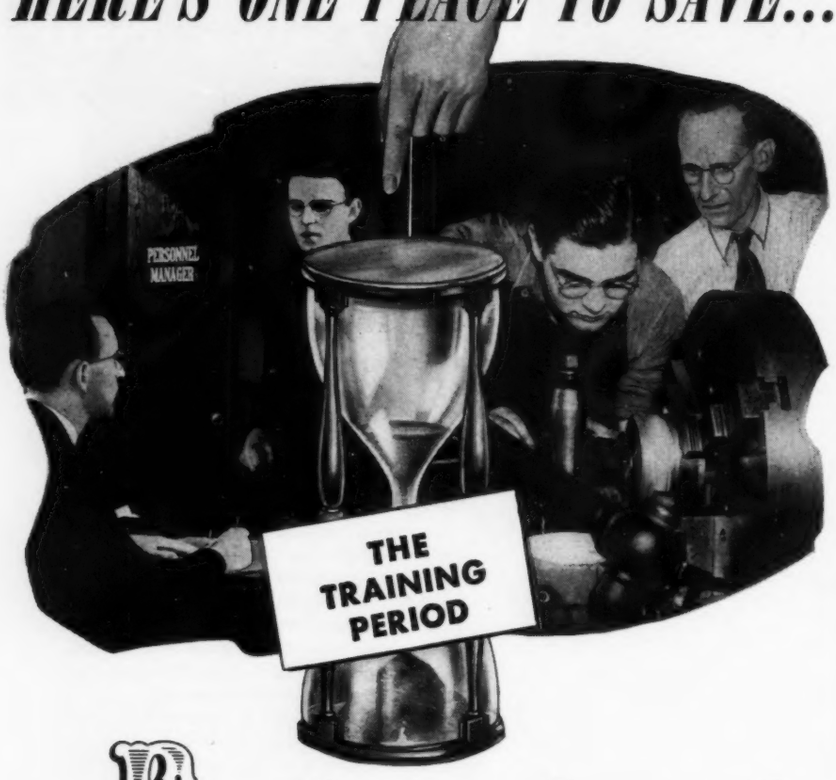
Name_____

Company_____

Street Address_____

City_____ State_____
(please print plainly)

HERE'S ONE PLACE TO SAVE...



...Precious days!

Now... when every tick of the clock counts... for national defense... for national security . . . the training program needs the latest, most effective tools. The present emergency is rapidly forcing out old concepts of training . . . rushing in the use of "movies" which offer great advantages over existing training methods.

The training movie made by you right in your own plant is "custom built" to suit your needs. It has all the admitted advantages of *training on the job.* But with less sacrifice of productive time; less time out for vital tools and machinery; fewer interruptions of your skilled employees; less spoilage of raw and semi-finished materials.

Furthermore, the training movie teaches *the one best method* to all trainees. It utilizes the skill of your most efficient employees without imposing on them the unfamiliar role of instructor.

Compact, portable, easy-to-operate B-M Equipment is available for your training program keyed to the unprecedented needs of today. The complete outfit includes everything you need to start a training program that will save precious days of productive time. Write for additional information.

Other Beneficial Uses of Sound Movies

Trainee Selection • Safety • Employee Relations
Time-motion Study • Upgrading • Foreman Training

J.A. Maurer, INC.
TRAINING FILM DIVISION

119 EAST 24th STREET, NEW YORK, N. Y.

operation in pairs from a common motor-driven cam shaft. Individual cams give quick make and break contact action. Pure silver inlays are used on contact surfaces to assure high current conductivity and avoid heating. Separate copper arcing contacts prevent burning of main contact surfaces. Controller drive mechanism consists of pilot motor, gear reduction unit, and geneva gear. Overtravel protection is provided by auxiliary cam-actuated switches. The motor may be supplied for 115 or 230 volts d.c. and 110, 220 or 440 volts, a.c. Optional features such as remote position indication, follow-up attachment and time delay operation, can be provided. Westinghouse Electric & Mfg. Co., East Pittsburgh.

Dial Indicator Gage

With this dial gage inspector can see exactly how the work varies in diameter from the master or specified dimensions. Has an adjustable lower anvil with rounded lips for easy insertion of the work. Upper

anvil operates under an auxiliary spring tension to maintain a constant and uniform pressure at all times. Backstop is adjustable over various diameters. Can be made for any diameter from the smallest fraction of an inch up to many inches. Contact point is located underneath the plug and there are two horizontal locating points, one of which is shown part way up the plug. Locating contacts are interchangeable for different-sized holes. Federal Products Corp., 1144 Eddy St., Providence, R. I.

Centrifugal Pump

No. 206-A motor-driven centrifugal pump is similar in design and characteristics to the No. 206 pump. Small diameter makes it suitable for installation where the space is limited. Has a depth of submergence of $9\frac{1}{16}$ in. Fitted with grease-sealed ball bearings and stainless steel shaft, integral with motor. Hydraulically balanced, and has an aluminum bronze impeller designed to allow abrasives to be discharged without excessive wear in the housing. Totally inclosed motor gives protection against dust and vapor. Furnished with $\frac{1}{2}$-hp. motor and is powered to handle liquids

ARMS FOR DEFENSE!

● Human arms! The arms and hands of men working along the production lines in thousands of industrial plants! They are "arms of defense" as vital to our national security as arms in the military sense of the word.

But, for efficiency these arms and hands need good tools plus proper direction — just as good soldiers need effective weapons plus proper training in handling them.

Files. In this great small-tool requisite, the world's largest file factories are working to meet defense industries' heavy needs. And they'll always be good files — up to the standard and uniformity which have enabled Nicholson for years to guarantee Twelve perfect files in every dozen.

. . . Files to speed the arms that wield them. . . . Files with plenty of bite when there's a lot of metal to be removed. . . . Files with correct cut and an even cutting surface when smooth finish is required. . . . Files with the toughness and proper hardness for long serviceable life. . . . Files in every practical design and size to assure The right file for the job.

Nicholson and Black Diamond brands are available through your mill-supply house. FREE TECHNICAL BULLETINS on special-purpose files for brass, aluminum, stainless steel, die and foundry castings, die-making, shear-tooth and lathe filing. Specify the ones you are interested in.

NICHOLSON FILE CO. • PROVIDENCE, R. I., U. S. A.

(Also Canadian Plant, Port Hope, Ont.)

NICHOLSON FILES

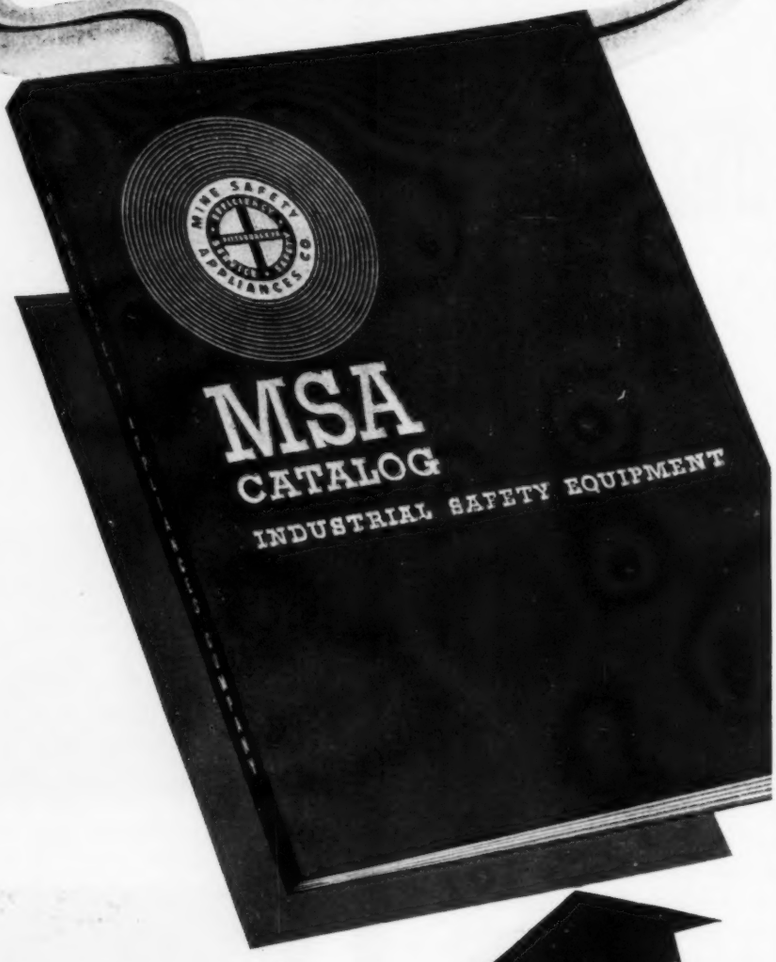
FOR EVERY PURPOSE

NICHOLSON U.S.A. MADE IN U.S.A.

HERE ARE THE FACTS-

CONDENSED FOR READY REFERENCE

ON THE MOST COMPLETE LINE OF APPROVED SAFETY EQUIPMENT EVER DEVELOPED!



Your copy of this "Safety Equipment Encyclopedia" awaits your request — one hundred and forty-eight pages of solid, useful information on M·S·A's protective equipment for your every industrial hazard. Just ask for Catalog 5-B—we'll forward it promptly, without obligation of any kind.

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District Representatives in Principal Cities

up to 1,000 S.S.U. At 1,725 r.p.m. and pumping water, the discharge varies from 20.5 g.p.m. at 5 ft. total head to 8.5 g.p.m. at 11 ft. total head. Brown & Sharpe Manufacturing Co., Providence, R. I.

Fluorescent Lighting System

RLM Lite-Line system of fluorescent lighting provides unbroken lines of light, higher levels of illumination, it is claimed. Utilizing 48-in. Mazda fluorescent lamps, the units are available in single and double reflector lengths, which may be joined together in series to form a continuous fixture of any desired length. May be installed on the ceiling or suspended at the required mounting level for general or localized lighting. Illumination provided by twin lamp units can be increased approximately one-third when two-lamp units are purchased with triple lamp reflectors. The change-over to triple lamp operation can be accomplished by installing the additional ballast, compensator, socket, switch, and lamp. Benjamin Electric Mfg. Co., Des Plaines, Ill.

Conveyor Belt

The ability to hold metal fasteners to a degree only previously attained by fabric construction, plus the extreme flexibility of cord construction, and added qualities that increase the capacity and life of conveyor belts, are features claimed for Homocord by its manufacturers. Manhattan Rubber Mfg. Division, Passaic, N. J.

Fractional-Horsepower Motor

Built specifically to meet the requirements of machine tools and other industrial applications where frequent start-stop service, plugging, and exposure to metal dust

are encountered. Available in ¼-, ⅓-, ½-, and ¾-hp. sizes. Totally inclosed construction protects motor from abrasive metal dust, chips, cutting compounds, and other foreign materials. General Electric Co., Schenectady, N. Y.

Cleaner

Described as a soapless soap powder, Coldfoam dissolves immediately in cold or hot water, hard or soft, and makes suds without soap, fats, or oils. Suitable for cleaning paint and other general cleaning purposes in factory or institution. Dries

DON'T PAY

FOR CURRENT LOST IN TRANSIT!

"LO-X" BUStribution DUCT increases current carrying ability — minimizes losses from heating and voltage drop.

"LO-X" the latest addition to Bull Dog's Flexible Electrical Distribution Systems, assures industrial users of electrical power of ample voltage at the point of application—motor, welder, inductive load—*wherever and whenever needed.*

"LO-X" is designed especially for the most efficient distribution of current in the conductors, and for the most effective heat dissipation characteristics. The result is greater current carrying ability, lower temperature rise and less voltage drop due to reactance.

"LO-X" may be used alone, or it may be used as a Feeder with Bull Dog's "Plug-in" type BUStribution DUCT and associated fittings. Whatever the installation, "LO-X" affords a high load capacity, better voltage regulation, greatly reduced line drop—and consequently more efficient and uniform operation.

"LO-X" BUStribution DUCT is available in from 500 amp. to 4,000 amp. capacity, 600 volts or less, single phase, three phase, and three phase 4 wire. Write for complete information, or ask to have a Bull Dog sales engineer call on you.

This is an end view of a standard section, three phase "LO-X" BUS DUCT. Reactance drop is kept to a minimum through extremely close spacing of bus bars in a specially designed assembly. This design with its minimized magnetic field permits the use of a rugged steel duct casing with no sacrifice of efficiency.

For welder installations such as the one shown here, and for similar inductive loads, especially at low power factors, "LO-X" BUStribution DUCT affords a high load capacity, better voltage regulation, and consequently more efficient and uniform operation.

BULL DOG

ELECTRIC PRODUCTS CO.

DETROIT, MICHIGAN

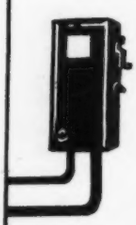
Bull Dog Electric Products of Canada, Ltd., Toronto, Ontario

MANUFACTURERS OF Vacu-Break Safety Switches, Circuit Master and SafToFuse Panelboards, Switchboards, Duct Systems—FOR LIGHT AND POWER

Bill-- Here's a tip to help you get that new plant operating sooner

"We've found that we can save as much as 50% of the time required for installing control by using G-E combination starters for the motors in our plant." ★

HERE'S WHY G-E COMBINATION STARTERS CAN BE INSTALLED MORE QUICKLY



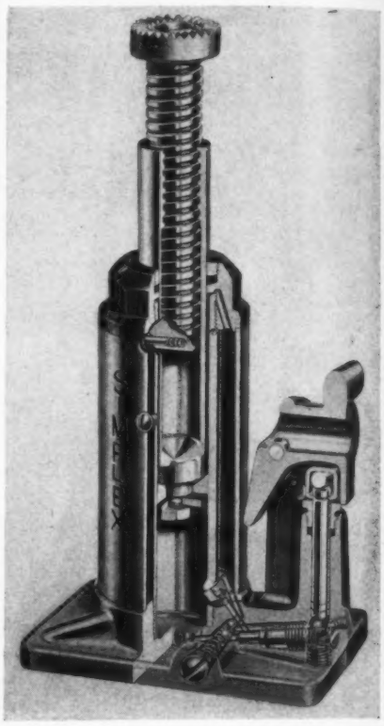
THIS	Instead of	THIS
1	Devices to mount	2
2	Lengths conduit to cut	3
2	Conduit ends to thread	4
6	Wires to pull	9
6	Power connections to make	12

★ *Statement by R. L. Mitchell, master mechanic, Fernstrom Paper Mills, Inc., Pomona, Cal.*

GENERAL ELECTRIC

four times faster than water, leaves no water spots, streaks or film, it is claimed. One pound makes 40 gal. of solution. The Savogran Company, India Wharf, Boston.

Hydraulic Jack



Heavy duty hydraulic jacks, in 3-, 5-, 8-, 12-, and 20-ton capacity sizes, include such advantages as neoprene oil resistant seals; pressure tested malleable iron top nut and base; machine-ground ram; fully lapped sleeve; ball-type valves, needle-type load release; center ram for proper balance; and a convenient carrying handle. Templeton, Kenly & Co., Chicago.

Electronic Synchronizer

Designed to be used with non-synchronous time and power tube contactor to obtain synchronous operation of resistance welders. Small and compact, in a dust-proof steel cabinet, approximately 30x12x 12, for wall mounting. Easily wired to any existing non-synchronous timer. Has an adjustment for any value of power factor encountered in welding transformers. Weltronic Corp., 3080 E. Outer Drive, Detroit.

Centrifugal Pumps

Streamlined throughout the line of Westco side suction centrifugal pumps includes flexible coupling drive models in sizes 1½ to 6 in. inclusive, and other models in sizes 1½ to 4 in. Cover with extra deep packing box, separate from volute body. Inclosed or semi-open impellers are supported on oversized ball bearings and are hydraulically and mechanically balanced. Inclosed style recommended for handling clear liquids, has triple-faced wearing surface. Can be adjusted to compensate for wear. Semi-open, non-clog impellers are designed for liquids containing foreign material in suspension. Special pumps for

handling corrosive or abrasive liquid can be furnished. Discharges can be installed in four positions without reducing the accessibility of the stuffing box. Micro-Westco, Inc., Bettendorf, Iowa.

Surface Troffer

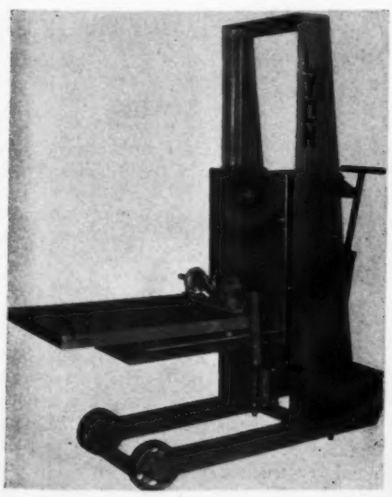
Designed to produce higher levels of fluorescent light with pleasant ceiling illumination on both close-ceiling and suspension mountings. Two types of surface troffers accord "add-on" feature that makes it possible to increase lighting capacities at any time without disturbing the original installation. The base type supplied with ornate cast ends and the continuous extension type furnished with a cast joiner, in sizes for 2 or 3 40-watt fluorescent lamps. Can be mounted as individual units or in continuous arrangements. Side baffles of the surface troffers effectively shield the lamps. However, additional shielding can be had with egg crate louvres. The Edwin F. Guth Co., 2615 Washington Ave., St. Louis, Mo.

Conveyor and Feeder

Vibrating conveyor and feeder, known as the Free-Flow, operates on the lift-throw principle, with the motion of the trough becoming increasingly horizontal with the progress of each cycle. Oscillating arms which actuate the trough are mounted in special rubber bushings, which store the forward and return forces to reduce power consumption. Trough can be of any material, open or inclosed. Volume can be controlled and material can be conveyed up inclines to 15 deg. Standard Transmission Equipment Co., 416 West 8th St., Los Angeles.

Hydraulic Die Handling Truck

Truck has a revolving table arranged to revolve with stops at each 90 degrees. In standard position the table extends about 1 ft. beyond the edge of the wheels, so that the tables may be put close to the press when taking out or putting dies into the press. Equipped with a winch for pulling dies on and off. Truck illustrated has 1,000-lb. capacity; table 24x36 in.; lowered height 12 in.; elevated height 51 in.; 2-



Thanks Joe . . . we're already using combination starters . . . they're safer

"We have found that our men can maintain G-E combination starters without danger, thanks to the safety-interlocked enclosure which separate units do not have."★

1 SAFER because the circuit switch has ample capacity to interrupt stalled-rotor current of the controlled motor.

2 SAFER because the cover can't be opened as long as the switch handle is in the ON position and power is applied to exposed parts.

3 SAFER because, whenever the cover is open, power can't be applied to the starter by accidental closing of the switch handle.

★ *Statement by Raymond Dingler, chief electrician of a large western cement plant*

Send for "How to Get More for Your Control Dollar" (GES-2456) General Electric Company, Schenectady, N. Y.

GENERAL ELECTRIC

VENTILATION SPEEDS UP DEFENSE PRODUCTION

America's defense production must go up super-swiftly—steadily—surely. In this *good ventilation* plays an important role as an essential factor of efficient plant operation.

DIEHL *VENTILATING EQUIPMENT*

• STEPS UP MAN-HOURS

Proper atmospheric condition in the plant minimizes time-out from illness — reduces fatigue.

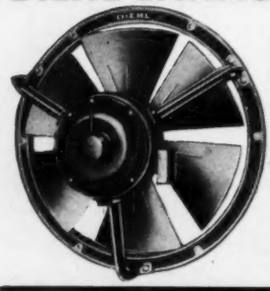
• CUTS DOWN MATERIAL WASTE

Good ventilation keeps workers keen and "on their toes" — assures greater accuracy — cuts down waste.

• SPEEDS PRODUCTION

Proper plant ventilation contributes to the efficient use of men, materials and machines.

DIEHL EXHAUST AND VENTILATING FANS



Products of 52 years of specialized fan manufacturing experience. Available in a wide range of types and sizes for the efficient, dependable and economical moving of air under various plant conditions. Our engineers will gladly analyze your requirements and submit recommendations. For maximum results at minimum costs, specify DIEHL.

DIEHL MANUFACTURING CO., Elizabethport, N. J.
Electrical Division of THE SINGER MANUFACTURING CO.
Atlanta Boston Chicago Dallas New York Philadelphia

383

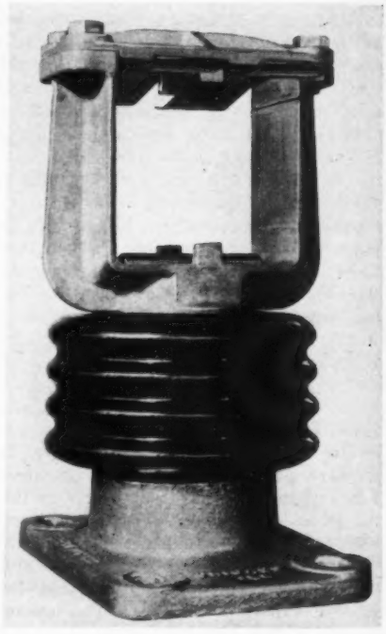
speed hydraulic hand pump. Can be furnished with other capacities and specifications, and with motor-driven pump. The Lyon Iron Works, 685 Madison St., Greene, N. Y.

Photo-Electric Relay

Sun-Switch is used to control electrical circuits in accordance with the rise and fall of natural illumination. The user chooses the two lighting levels at which he wishes the load switched on and off, and adjusts the calibrated dials to the corresponding foot-candle reading. Operation is entirely automatic. Housing is weatherproof, dimensions 10¾x5⅝x3½. Control circuit uses a type 921 phototube and two type 6J5 tubes. Operation is from 110 volts, 50 or 60 cycles, a.c. United Cinephone Corp., Torrington, Conn.

Indoor Bus Support

Two channel or square tube bus for heavy duty circuits. Clamps with opening up to 12-in. square mounted on insulators



of corresponding strengths are available. Delta-Star Electric Co., 2400 Block, Fulton Street, Chicago.

Blow Torches

"Superior" mechanics' torches, Nos. 141 and 142. No. 141 is for gasoline and No. 142 is for kerosene. Blow-proof pump is a feature. P. Wall Manufacturing Supply Co., 3126-3166 Preble Ave., North Side, Pittsburgh.

Steel Stools

Features of the line of steel stools recently placed on the market include all-welded, unbreakable construction; unusually large seat area (187 sq.in.); strong channel brace footrest; round edge steel band construction with no rough edges to snag clothing; tapered legs to prevent tip-

SINGLE REDUCTION
Westinghouse Type S, single reduction, explosion-proof gearmotor. (Standard ratios 1:12 to 5:1). This type available for all types of enclosures.
DOUBLE REDUCTION
Westinghouse Type D, double reduction gearmotor. (Standard ratios 5.6:1 to 10.0:1). Compact design is the result of building reduction gears and motor as one complete unit.
THERE'S A
Westinghouse
Gearmotor
FOR EVERY TYPE
OF SLOW-SPEED DRIVE
TRIPLE REDUCTION
Westinghouse Type T, triple reduction gearmotor. (Standard ratios 40:1 to 200:1). The wound rotor motor illustrated here, is adjustable in speed and starts easily under load.
SPECIAL ENCLOSURE
Westinghouse Type FD, double reduction gearmotor. (Standard ratios 10:1 to 40:1). This splash-proof enclosure and other special enclosures are available throughout the line.
WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, EAST PITTSBURGH, PA.
J-07170
Westinghouse
GEARED DRIVES

. . . and the night shift production was lost!

lights OUT . . . power OFF . . . production STOPPED, right in the shank of the evening. All because a main feeder that used to work 40 hours a week couldn't take overloads 24 hours a day, 7 days a week, *week after week.*

It can happen in *any plant* that's turning night into day to get out production. Here's how. To begin with, the wire in old circuits is apt to be dried out with age and in even worse condition where it runs too close to boilers, steam lines, etc. Then, extensions of existing feeders and too many additional branches cause overloads, overheated conductors and insulation breakdown. And, finally, continuous 24-hour operation boosts circuit loads 'way up and keeps them there, ready to make trouble when you least expect it — unless you wire with Rockbestos *permanently insulated* wires for greater carrying capacity.

Every wire of the 118 standard constructions in the Rockbestos line has what you need to prevent production delays caused by wire failure. They are heatproof, fireproof and resistant to moisture, oil, grease and corrosive fumes. Send for our catalog and learn more about them. Rockbestos Products Corporation, 800 Nicoll St., New Haven, Conn.

1. Rockbestos A.V.C. Boiler Room and Lighting Wire
2. Rockbestos A.V.C. Power Cable
3. Rockbestos All-Asbestos Power and Rheostat Cable

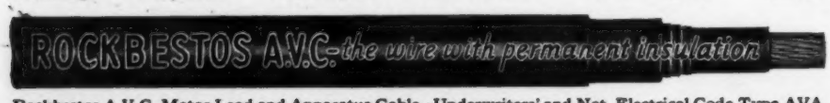
Numbers 1 and 2, Underwriters' and N.E. Code – Type AVA – max. operating temperature 230°F., number 3, Type AI, max. operating temperature 257°F.

TEN TESTED ROCKBESTOS VALUES that will pay you dividends

1. HEATPROOF
2. FIREPROOF
3. PERMANENT
4. Lower maintenance cost
5. Resists heat and vibration
6. Saves work
7. Oil, Grease and Moisture resistant
8. High overload capacity
9. Permanently flexible
10. Greater carrying capacity

Also refer to McGraw-Hill Electrical Buyers Reference

New York Pittsburgh Buffalo St. Louis Cleveland Los Angeles San Francisco Detroit Portland, Ore. Chicago Seattle

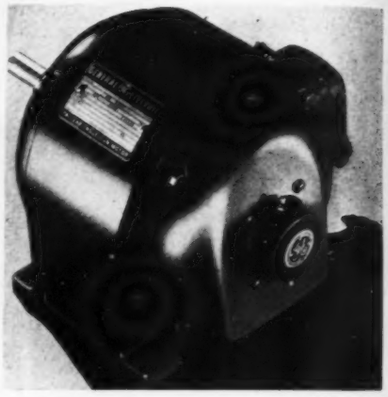


Rockbestos A.V.C. Motor Lead and Apparatus Cable – Underwriters' and Nat. Electrical Code Type AVA – one of 118 different permanently insulated wires.

ping; and interchangeable accessories. Seven heights, from 18 to 30 in., and 112 models, are available. Finished in high-grade baked enamel, standard colors are green or brown. Other colors available at slight additional cost. Lyon Metal Products, Inc., Aurora, Ill.

Splashproof Motor

Tri-clad splashproof, ball-bearing, polyphase induction motors in sizes from 1- to 15-hp. are designed for applications where splashing water and other liquids are present. Ventilated openings of the stator frame and end shields are baffled to block the entrance of splashing liquids. Cast baffles within the side openings of the stator frame block splashing from the side. Windings are impregnated with a special synthetic resin varnish. General Electric Company, Schenectady.



Screwdriver

The Fitzem screwdriver can be used on both Phillips recessed-head and slotted-head screws. Blade is reversible and interchangeable; manufactured of molybdenum steel. Handle is made of extruded plastic and is unbreakable, non-chipping, non-splitting, shockproof, and is not affected by oil, water, or grease. Available in sizes 1 to 4, and in various blade lengths. The Servwell Products Co., Cleveland.

Test Pump

A testing device, known as the Testall Pump is available for determining the maximum safe life of fire extinguishers tells the condition of each extinguisher by testing hydrostatically the shell and hose for strength, through the hose and nozzle. Is approved by the Factory Mutual Laboratories with a definite procedure for testing extinguishers, engines, hose, sprinkler systems. Can be carried by one man. American-La-France-Foamite Corp., Elmira, N. Y.

Bearing

Babbited-bearing common flat box, series 2-1200, with maroon colored crackle-finish housing. For moderate speed and power requirements, it is available in 24 sizes, for shafts ½ to 3 in. in diameter. Features include compactness; sloping surfaces between cap and base to maintain concen-

CORN PRODUCTS REFINING COMPANY ARGO, ILLINOIS

. . . INCREASED THEIR PRODUCTION AND STORAGE CAPACITY . . . IMPROVED THEIR WAREHOUSE HOUSE-KEEPING . . . REDUCED BAG SPOILAGE . . . WITH

TRADE AUTOMATIC MARK

FORK TRUCK PALLET SYSTEM

The extent to which the "AUTOMATIC" fork truck pallet system for handling starch has contributed to this well-known company's production and handling efficiency is clearly indicated by the above statement.

By being able to utilize the full *vertical* storage capacity of their 130 x 170 foot warehouse, this company can now produce upwards of the 25 different brands in advance of their customers' actual order requirements. Thus, considerable savings are being effected in production costs, plus a general improvement in warehouse housekeeping, and a considerable reduction in bag spoilage is being experienced.

As illustrated, the pallet loads are stacked three high. Each pallet load is built up with thirty 140-lb. cotton or burlap bags or forty 100-lb. paper bags, as the case may be. The truck handles 30 to 50 pallets per hour depending on production and also keeps one to five loading doors operating on full schedule.

Perhaps, you have a similar problem. Let the experience of this company be your guide to satisfactory material handling by investigating the "AUTOMATIC" fork truck pallet systems. Write, 'phone or wire for an "AUTOMATIC" representative. No obligation.

AUTOMATIC TRANSPORTATION CO.
Div. of The Yale & Towne Mfg. Co.
38 W. 87th STREET CHICAGO, ILL.

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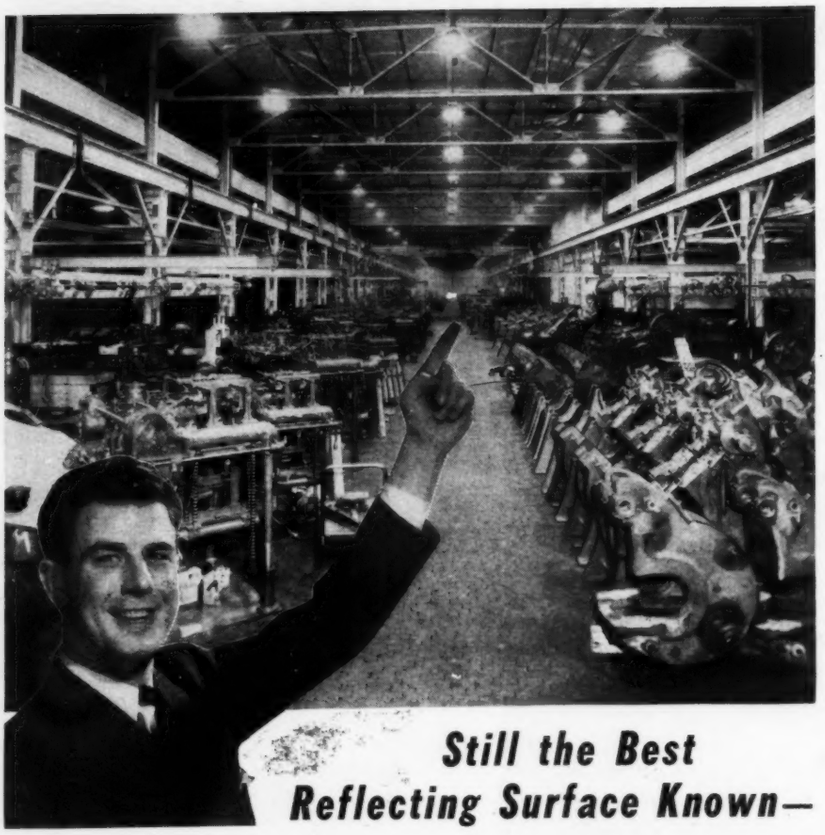
TRADE **AUTOMATIC** MARK

MANUFACTURERS FOR OVER THIRTY YEARS

Electric Propelled INDUSTRIAL TRUCKS



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PORCELAIN ENAMEL

● So far, no other reflecting surface for industrial lighting fixtures has ever duplicated the advantages of this vitreous fired porcelain enamel.

Here is the finish that gives you proper diffusion of light without a trace of reflected glare. Here is the finish that is permanent—that can never tarnish or corrode. Here is the finish that is easy to clean—by merely wiping with a damp cloth—to maintain the highest standard of reflecting efficiency. It gives you all the light you pay for—now, and for years to come.

GOODRICH INDUSTRIAL LIGHTING

Porcelain enamel finish is available throughout the complete Goodrich line, which includes all R. L. M.-approved fixtures, fluorescent fixtures, and hundreds of sizes and styles for general and local industrial illumination.

Literature is available on all Goodrich fixtures.

SOLD ONLY THROUGH ELECTRICAL WHOLESALERS

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ELECTRIC COMPANY
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GENERAL OFFICES AND FACTORY: 4604 BELLE PLAINE AVENUE, CHICAGO, ILL.

tricity; removable shims; non-protruding cap bolts; easily accessible cap bolts; elongated holes for base holding-down bolts, to provide adjustment for shaft alignment. Link-Belt Co., 307 N. Michigan Ave., Chicago.

Belt Lacer

No. 9 portable belt lacer is designed to generate pressure of over 30,000 lb. permitting the embedding of belt hooks flush with the surface of the belt and clinching the point. Solid faced jaws assure proper clinching of every hook point. Claimed to produce straight line of well-rounded loops which makes possible the use of a larger size connecting pin. Clipper Belt Lacer Co., Grand Rapids, Mich.

Ball-Bearing Drill

Lightweight, compact, high-power drill, equipped with antifriction bearings, splined gear mounting. Choice of end or side handle, particularly adapted to aircraft work. Drilling capacity in steel ¼ in.; in hardwood, ½ in. Standard speed 2,000 r.p.m. Also available in speeds of 3,500 and 5,000 r.p.m. The Black & Decker Mfg. Co., Towson, Md.

Steam Cleaner

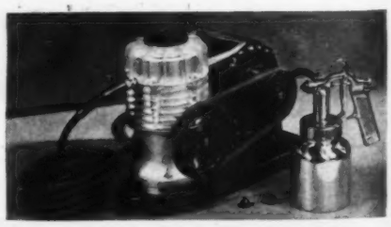
Hypressure Jenny steam cleaner, Models JL and JM, have just been announced. Said to be more powerful than previous models, providing faster and more thorough cleaning of automotive parts, chassis, motors, machinery, floors, walls, and exterior of buildings. Simplified automatic compound feed. Greater portability and greater simplicity of construction and operation are features. Homestead Valve Mfg. Co., Coraopolis, Pa.

Lamp Shock Absorber

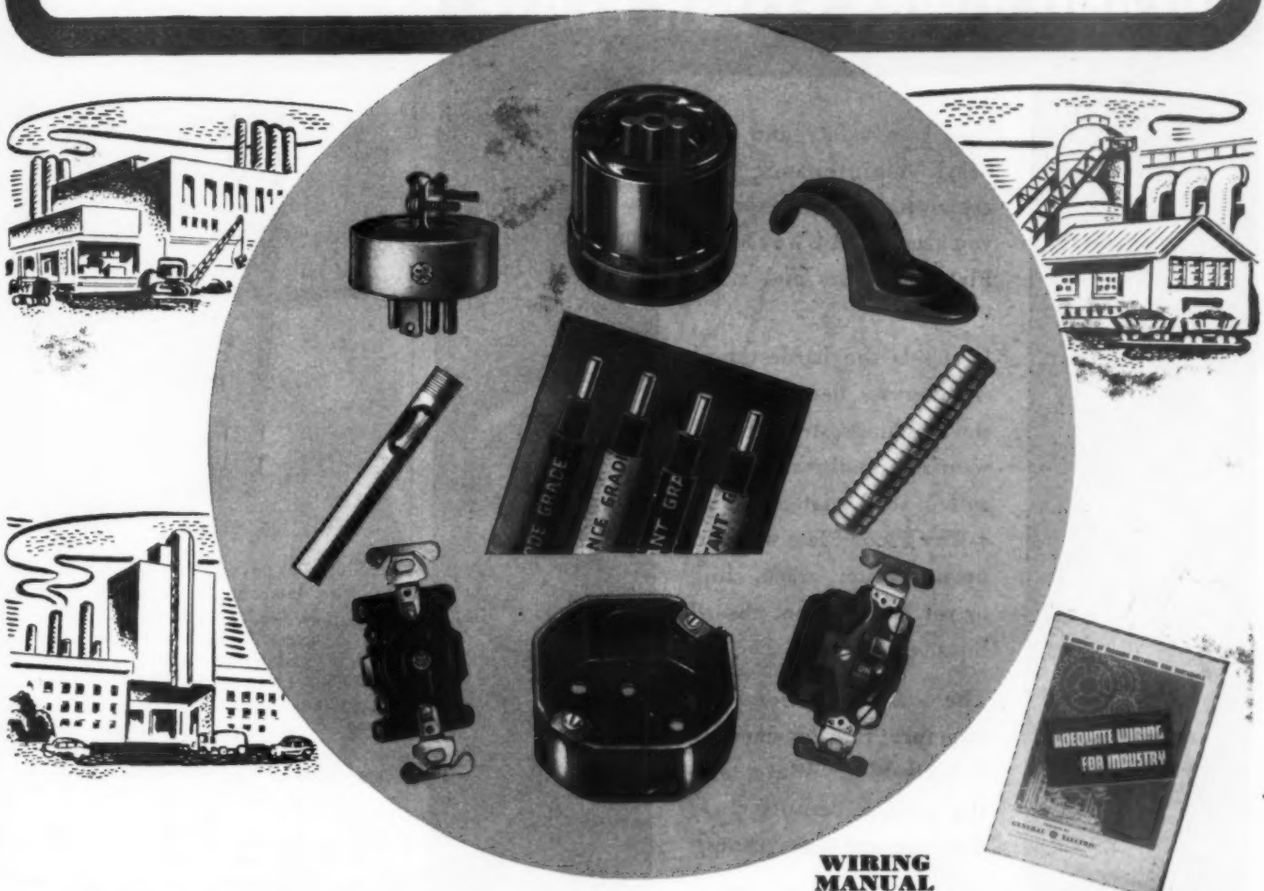
It is claimed that the Model M-T lamp shock absorber greatly increases lamp life wherever lamps are subjected to vertical or horizontal shock. Fixture and lamp support float in flexible sponge rubber, so that shock in all directions is equally absorbed. Synthetic rubber "skin" protects sponge rubber mounting from corrosive atmospheres. Easily attached to any fixture accommodating from 100- to 750-watt lamp. The Lintern Corporation, 7960 Lorain Ave., Cleveland.

Paint Sprayer

Speed Sprayer No. 890 is an all-purpose, heavy-duty spray outfit. Built on the principle of a diaphragm it delivers clean air,



G.E. Offers
WIRING MATERIALS
for Today's Needs



YOU'LL find exactly the right wiring materials for new wiring systems, for modernization work, and for maintenance in the G-E line. These materials are conveniently available in your territory, too. G-E Merchandise Distributors are located at all key points in the country.

G-E wiring materials all have the same uniform high quality and are designed to be used together and to give enduring service. The line includes conduit, wire and cable and wiring devices.

WIRING MANUAL FREE

General Electric has prepared a manual called "Adequate Wiring for Industry" which describes modern wiring methods and materials. You'll find it helpful in checking the wiring in your own plant. The manual interprets wiring in terms of savings and service.

For a free copy of this manual and for further information about G-E wiring materials see the nearest G-E Merchandise Distributor or mail the coupon.

GENERAL ELECTRIC

General Electric Company
Section CDW-1376
Appliance and Merchandise Dept.
Bridgeport, Conn.

Sirs: Please send me free a copy of "Adequate Wiring for Industry" with information about G-E Wiring Materials.

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Stop Costly Floor Repairs with

INLAND 4-WAY FLOOR PLATE

You gain safety and end costly maintenance and replacement troubles when you use Inland 4-Way Floor Plate on floors and stairways.

It stands the hardest possible service, because it has the toughness, strength and wearing qualities of fine rolled steel plate. Inland 4-Way Floor Plate will not burn, splinter, crack, chip, or rot, and will not absorb liquids and odors.

The 4-way projections give structural reinforcement to Inland Floor Plate, and the pattern permits ready drainage and easy cleaning.

Install Inland 4-Way Floor Plate to end costly floor repairs. Write for catalog giving full information.

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INLAND STEEL COMPANY

38 S. Dearborn Street, Chicago

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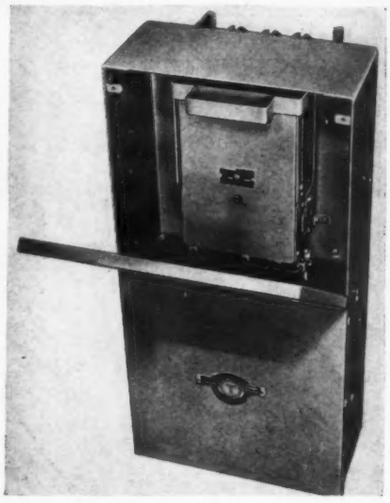
because it is claimed no oily parts come in contact with the air. It is permanently lubricated at the factory. Sprays inside and outside paints, enamel, laoquer, varnish, kalsomine, insecticide, mothproofer, and can supply compressed air. Can also be used as a vacuum pump. W. R. Brown Corp., 5720 Armitage Ave., Chicago.

Capacitor

For use with the Flex-A-Power feeder distribution system. So-called capacitor Flex-A-Plug, consisting of a fusible heavy duty switch or circuit breaker in combination with a capacitor may be utilized to



improve the power factor of a system. Can be distributed approximately in the same manner as the load, are easily installed and can be moved as loads are relocated. Discharge resistors are built into each capacitor unit to meet the National Electrical Code requirements for safety discharge at 50 volts or less in one minute. Available in ratings of 230 and 575 volts. The Trumbull Electric Mfg. Co., Plainville, Conn.

Fans

Backward and forward curved blower fans for all heating, cooling, and ventilating applications. Type FC fans are available in single and double widths, in sizes from 4½ to 60-in. wheel diameter. Type BI fans range from 15 to 66 inches. Capacities from 295 to 4,500 c.f.m. The Trane Co., La Crosse, Wis.

Vacuum Pump

Rotary type operating without gears, spring or valves. Complete with 1/12-hp. motor. Slight adjustment converts pump from vacuum to pressure service. Pump and motor measure 8⅛ in. long by 4½ in. in diameter. Can be easily lifted. Air capacity is 0.5 c.f.m. Gast Manufacturing Corp., Hinkley St., Benton Harbor, Mich.

Exhaust Hose

A light flexible hose especially constructed for conducting fumes and abrasive dust. Made with smooth rubber tube, helical wire reinforcement plies of fabric, and corrugated rubber cover, this hose is easily bent at short angles and may be

It's 9 to 1 you're headed for trouble, too, IF you don't look to your Electrical Wiring NOW!

Look ahead now and sidestep trouble later. Just how safe—or unsafe—is the electrical wiring in your plant? Better check before it's too late . . . before new defense contracts add an extra burden on what may be already overloaded circuits. Idle men, machines and penalties for lagging production are costly. What's more, even without that added strain, authorities agree that nine out of ten industrial plants need rewiring.

Is your plant one of them?... Anaconda's "Industrial Wiring Survey" and the "Industrial Wiring Guide" will help you to find out. The Survey enables you to make a step-by-step analysis of your electrical circuits; the Guide tells you how to correct the conditions found.

Play safe! Sidestep electrical failure later by sending for your free copies of the Survey and the Guide *now*. 41350

Two free books for you! They'll simply, surely find any electrical wiring trouble in your plant; explain how to correct it. Write for them today!

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USE MODERN IMPROVED *Anaconda Wire & Cable*

PROFIT BY
The Combustion Engineering Co.'s
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CAREYSTONE
Corrugated Roofing selected for this assembly and shipping building at Chattanooga, Tenn. 230 ft. long by 100 ft. wide and 56 ft. high.

SPECIFY

Careystone
ASBESTOS-CEMENT

CORRUGATED ROOFING

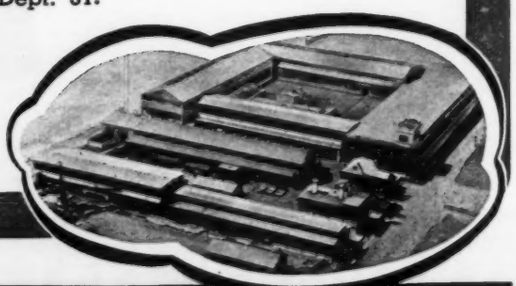
In the race for increased production, CAREYSTONE meets the call for speed. This unexcelled roofing and siding material—permanently combined Asbestos and Portland Cement—helps reduce "bottlenecks" caused by defense needs for metals.

Easily and speedily erected, CAREYSTONE Corrugated meets permanent as well as temporary needs, with little or no loss or waste when buildings are dismantled. Salvaged CAREYSTONE can be stored, sold, or re-used in new construction.

CAREYSTONE is fire-resistant and is widely used where acid and alkali fumes are prevalent. Contains nothing that can rust, rot or corrode. Its low first cost is practically the only cost—giving dependable service with minimum maintenance expense, year after year.

For complete details, call the nearest Carey Branch Office or write Dept. 31.

THE COMBUSTION ENGINEERING CO.
Chattanooga, Tennessee, Plant



THE PHILIP CAREY COMPANY • Lockland, Cincinnati, Ohio
Dependable Products Since 1873
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located right at the machine or spot from which the fumes and dust originate. Regular ends are built without wire for 3 in. from the end to facilitate fittings. Manufactured in sizes ranging from 2 to 12 in. in diameter, and in 8, 15, and 25-ft. lengths. B. F. Goodrich Co., Akron.

Fluorescent Fixtures

The Super Two-Hundred fixture for two 60 in. 100-watt lamps is a standard open-end unit available with and without apertures. Also available as a closed-end unit with fill-in sections for continuous installations. May be suspended by chain or by pipe. Hinged top renders parts accessible for replacement or for making wire connections. The fixture is wired with sockets, lamp starters, and high power-factor Tulamp ballast for 110–125, 199–216, or 220–250 volts, a.c. Day-Brite Lighting, Inc., 5411 Bulwer Ave., St. Louis.

Toilet Seats

Addition of ebonite in white pyroxylin finish to the line of popular priced Stasco ebonite black concave-type toilet seats is announced. Both black and white seats meet federal specifications. Made of indestructible vulcanized hard rubber, covered in seamless pyroxylin. Available in open or closed front, with or without cover, for regular bowl, and open front, less cover, for elongated bowl. Standard Tank & Seat Co., Camden, N. J.

Electric Truck Lift

Electric lift for servicing electric industrial trucks. Uses the principle of lifting the load from above by cable, leaving the work zone beneath the truck free of obstructions, and giving complete accessibility to all underside parts and lubrication fittings. Can be placed anywhere. Walker Manufacturing Company, Racine, Wis.

Industrial Rectifier

Electronic industrial rectifier supplies direct current from a.c. lines, for driving adjustable-speed motors up to 200-hp. rating. Units up to and including ½ hp. are portable and equipped with plug connections. For use on 50- or 60-cycle lines. Electron Equipment Corp., Palm Springs, Cal.

Paint Stripper

Constructed of steel with aluminum body containing 120-volt, 250-watt heating element, this electric paint stripper weighs less than 1½ lb., and is only 11 in. long. The Cool Guard or fender above the heated body remains cooler than the body,

Windings are protected from unusual moisture or dirt conditions by special "baked in" insulation treatment which greatly increases the life of the motor.

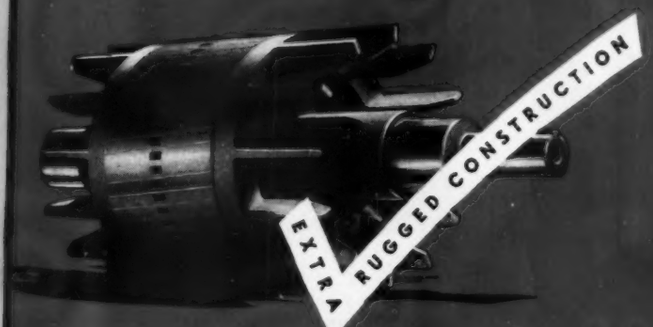
The cast iron frame and end shields are so constructed that the internal working parts of the motor are fully protected from falling dirt or dripping liquids.

check list

Thousands of men like you have been securing these plus values for years in the Master Motors they have been purchasing.

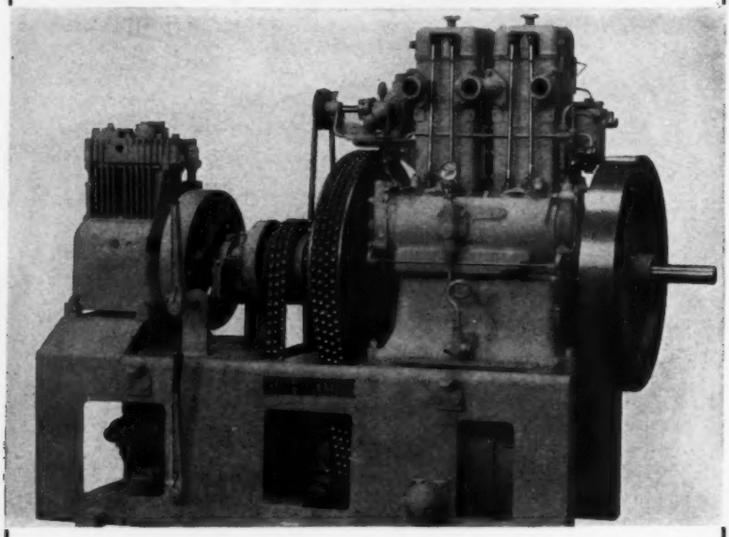
But what about you? Check the motors you have been purchasing against these construction features . . . most of these extra values are missing, aren't they? Well you can do something about it. Investigate the unusual ability of the MASTER organization to serve you economically.

THE MASTER ELECTRIC COMPANY
DAYTON, OHIO



Unusually heavy alloy steel shafts and oversize bearings add greatly to the durability of Master Motors. In Squirrel Cage motors the rotor windings are cast integral with the rotor laminations.

The rotor of every Master Motor is dynamically balanced to eliminate noise or destructive wear due to vibration from an out-of-balance condition.



H. E. Hill, Sales Manager of Lister-Blackstone, Inc., manufacturers of Diesel Engines, writes:

"On our combination marine auxiliary units fixed centers between the driving and driven machines are necessary. Veelos V-Belting eliminates the need for idlers or any means of belt take-up which would be necessary in the case of an endless belt drive. We find your claims conservative and expect satisfactory service over a long period."

The flexible, laminated construction of Veelos Belts not only ends need of gadgets for belt take-up—it ends wasteful slippage as well. Ask the Veelos Distributor.

CALL A V-MAN! Complex drive problems can be solved—just call a Veelos V-Man. He's a sales engineer specially trained in power transmission work. He's a "minute man," too, who comes promptly when you write.

MANHEIM MANUFACTURING & BELTING COMPANY
MANHEIM, PA.

VEELOS
V-BELT
ADJUSTABLE to any length
ADAPTABLE to any drive

NEW OCTOPUS FLAT TRANSMISSION BELTING! NEW POWERFUL GRIP ENDS SLIPPAGE! NEW GREAT RESILIENCE STOPS STRETCH! DEVELOPED THROUGH EIGHT YEARS OF RESEARCH, THIS BELTING PROVIDES MORE PRODUCTION AT LESS COST.

thus retarding fusion of paint flakes. Has 3x3-in. square blades with four beveled ground edges, interchangeable and regrindable. Known as Safety Paint Stripper, is offered in two models—"B" Standard, of polished steel, and "A" De Luxe, chromium plated. Heating Equipment Co., Rochester, N. Y.

Hot Tap

Type HET especially suitable for taking taps from either cable or flat bar. May be used for grounding, temporary taps, and jumping equipment to be repaired or replaced. Jaws which grip the hot conductor have grooved contacts designed to clamp cable, and serrated contacts to clamp flat bar. Rotatable eye clamping element is used on the tap. Can be supplied for any sizes of cable or flat bar. Burndy Engineering Co., Inc., 459 East 133rd St., New York.

Pushbutton Station

Designed for surface mounting in either vertical or horizontal position. Internal mechanism is self-contained on a molded block mounted on a metal base by two screws. Has two conveniently located mounting holes in opposite corners, and

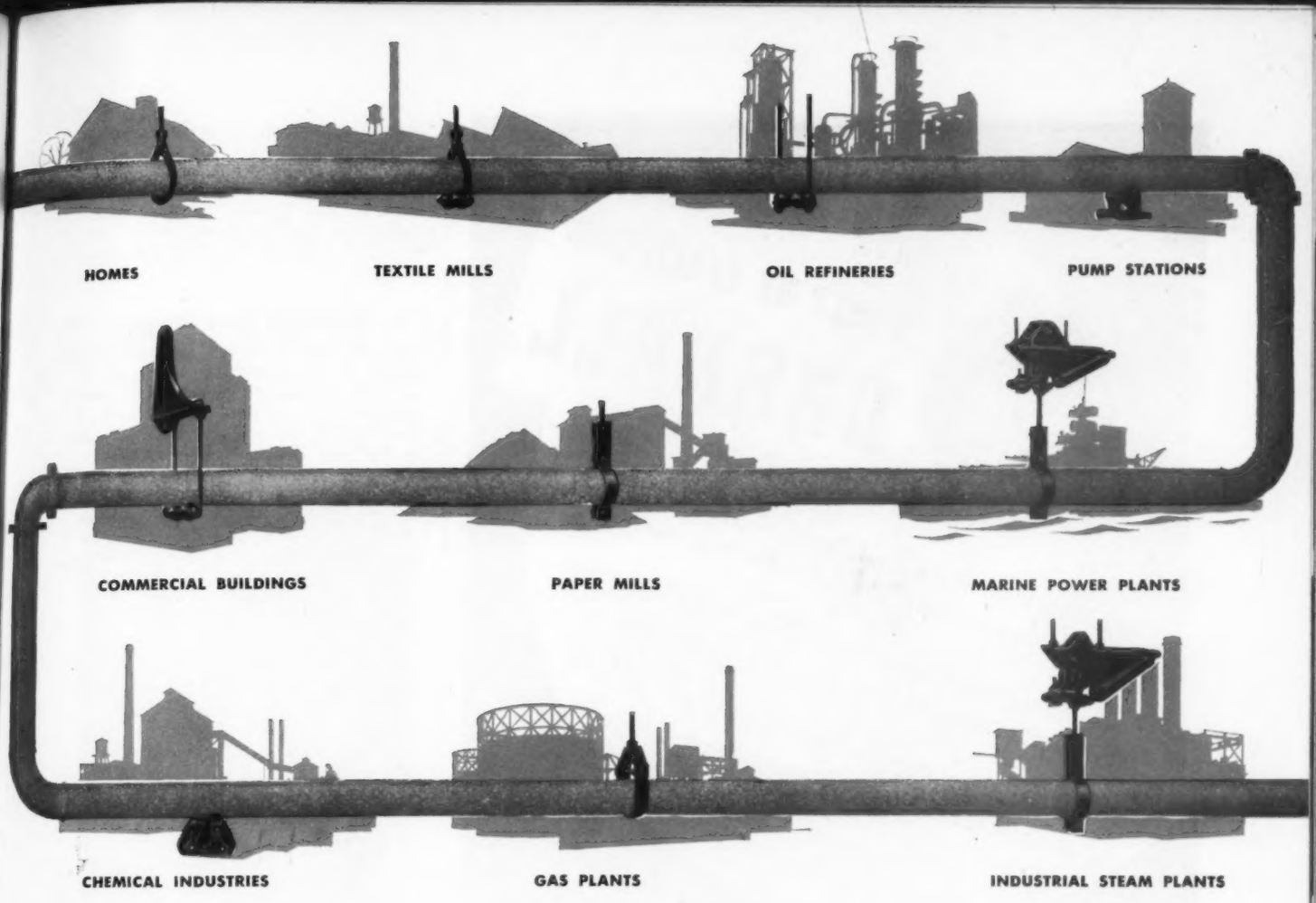
$\frac{1}{2}$- and $\frac{3}{4}$-in. pipe knockouts on both ends. Standard finish is black on machine gray, but special color combinations can be supplied. Electrical Division, Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.

Drum-Dumping Stacker

A self-locking worm makes it possible to hold the drum for as long as desired at any position. Control from the floor also permits the operator to reverse the tilt of the drum or barrel to slow down or stop the flow of material from the container. Lewis-Shepard Sales Corp., 245 Walnut St., Watertown, Mass.

A.C. Electric Arc Welder

Fifteen different welding heats between 20 and 175 amp. give accurate heat and



Pipe Hangers *Engineered* for each specific service

No longer is pipe hanging a haphazard matter of fastening pipes "somewhere, out of the road". Every application has its individual requirements.

Until Grinnell engineers attacked these problems, pipe hanging was given little attention. Now you can get professionally-engineered pipe hangers for every job you have to do! No more makeshift hangers that take time and only do a half-way job . . . no sagging pipes and costly maintenance . . . Grinnell Pipe Hangers include types and styles to hang *any* piping *anywhere.* They're faster, stronger, more compact . . . and easily adjustable *after installation.*

Write for complete catalog, "Grinnell Adjustable Pipe Hangers." Grinnell Co., Inc., Executive Offices, Providence, R. I. Branch offices in principal cities of the U. S. and Canada.

ADJUSTABLE PIPE HANGERS BY **GRINNELL**

WHENEVER **PIPING** IS INVOLVED

SAVE
MONEY BY SPECIFYING
DARNELL

Maximum Floor Protection. Darnell Casters and Wheels do not drag. Wear reduced to minimum.

No wracking of equipment. Darnell Products eliminate stress and strain. Trucks easier handled.

Increased employee efficiency. Easier rolling equipment eliminates "afternoon lag in energy."

SWITCH TO
THE ECONOMIES
OF
Darnell

• Install these quality products on all of your movable equipment and they will pay for themselves in EXTRA service, EXTRA floor protection and in EXTRA employee efficiency.

Write for 192-Page Darnell Manual

DARNELL CORP. LTD., LONG BEACH, CALIF.
36 N. CLINTON, CHICAGO • 24 E. 22nd, NEW YORK

penetration control. Penetration may be up to ¼ in. or more. Heats at 45 and 70 volts. Standard welder is for 230-volt, 60-cycle operation. Primary current, 1.75 amps. no load, 52 amps. full load, overall dimensions, 17x15x26, weight 190 lb. Ideal Commutator Dresser Co., 1416 Park Ave., Sycamore, Ill.

Infra-Red Heat Lamps

Of the three infra-red lamps recently placed on the market, two are clear for use with the standard gold-plated or Alzac reflectors, and the third is built with its own reflector lining sealed inside to keep it free from oxidation and the collection

of dust, dirt, and fumes. The manufacturer claims that the reflector lining will keep heat reflection value for the 6,000-hour life of the bulb, because it is made of pure silver. The filaments of infra-red lamps operate at lower temperatures than incandescent lamps, and develop infra-red radiant energy at wave lengths which have high penetration. Birdseye Division of Wabash Appliance Corp., Brooklyn.

Grinder

Grinder No. 612 is rated ½ hp. and is furnished with 6-in. diameter ¾-in. wide wheels. Features include fully inclosed guards, tool rests adjustable horizontally and vertically, adjustable shatterproof eye shields. Powered with a capacitor-type motor guaranteed against burn-out for 2 years. Baldor Electric Co., 4351-59 Duncan Ave., St. Louis, Mo.

Pneumatic Roller

A pneumatic roller for carriers on belt conveyors where the shock of impact is excessive. Made up of a series of 6-in.

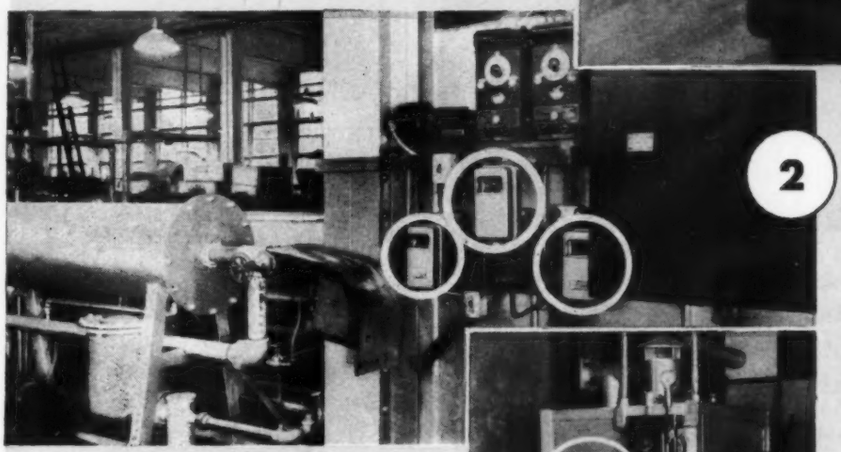
Here's how

TIME SWITCHES CAN BOOST YOUR PRODUCTION

THEY prevent lost time by having electric heating equipment ready for use when workers arrive.

This time switch turns on a solder pot to bring it to correct temperature before the start of the working day. It also turns the pot off automatically at the end of the day.

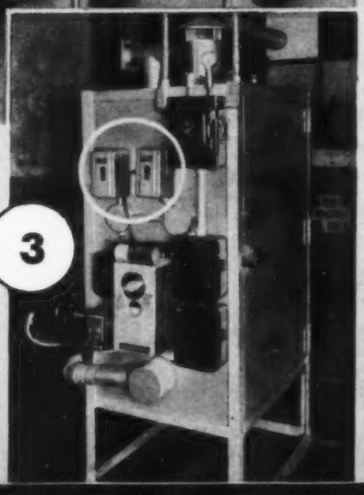
1



2

THEY automatically time intricate processes, permitting operators to give full attention to productive work.

The entire operation of this chain-conveyor annealing furnace is controlled by three time switches. They turn on the heating elements, start the motor-driven chain, turn water on for the gas mixer, and turn it off after the mixer has been shut off — all in a carefully timed sequence of operations.



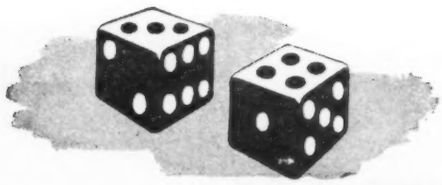
3

THEY complete, after working hours, processes that were started at the end of the day.

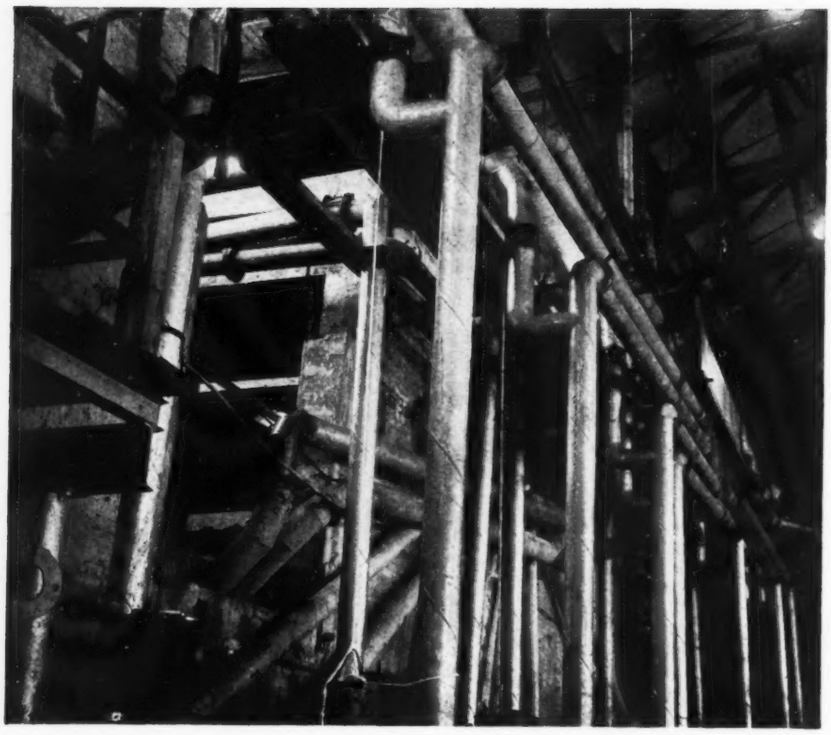
Here small coils are dried after dipping. One time switch starts an exhauster. A second switch turns the heater on—and off when drying is finished. The furnace can be loaded at the end of the day and the coils dried after working hours — thus completing an extra batch.

THESE are but a few of the many jobs G-E time switches are handling. The best part of it is that they're inexpensive, easy to install, and easy to adjust. It will pay you to check your own processes, and make a note of those that can be controlled automatically. Then ask the nearest G-E office to recommend the time switches best suited. General Electric, Schenectady, New York.

GENERAL ELECTRIC



A PIPING "NATURAL"



Engineers and designers have found a "natural" for industrial piping. It's ARMCO "Spiral Welded." By using this sturdy pipe many mills have saved up to 25 or 30 per cent on the cost of a single job. You can make similar savings.

When you specify ARMCO Pipe the entire job is pre-fabricated to exactly meet your requirements. Custom-built fittings are welded to straight pipe runs. A pair of flanges is eliminated at every bend and material costs are cut to the bone. What's more, erection is greatly simplified.

ARMCO Pipe assures efficient operation. It is smooth inside for high flow capacity. Lines are easy to keep clean. And fewer flanges mean fewer joints, less chance for leaks.

ARMCO Spiral Welded Pipe is available in diameters from 6 to 36 inches, wall thicknesses from 7/64 to 1/2-inch. Just send us your plans on that next job; we'll gladly submit a cost estimate and a sketch of our proposed design. The American Rolling Mill Company, 1751 Curtis Street, Pipe Sales Division, Middletown, O.

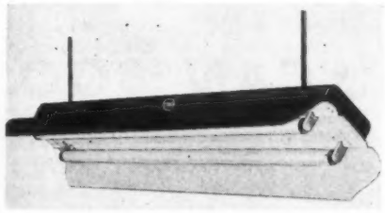
ARMCO

SPIRAL WELDED PIPE

pneumatic rubber units mounted on steel hub. Thick, wear-resisting treads are inflated and permanently sealed to prevent loss of air. Identified as Style No. 711 Pneumatic Impact Carriers. Stephens-Adamson Mfg. Co., Aurora, Ill.

Fluorescent Units

An industrial fluorescent unit, that is unusually easy to maintain, it is claimed. The ballast, compensator, and all wiring



are permanently located in the top channel, the reflector is removable during installation, cleaning, and maintenance. A specially baked enamel finish, which tests at 80 percent reflectivity, is also a feature. Two-lamp 100-watt and two-lamp 40-watt units, with open or closed ends, are available. The Garcy Lighting Co., Unit of Garden City Plating & Manufacturing Co., 4224-46 Lincoln Ave., Chicago.

Plastic Coating

A plastic coating of the structural type, Marlo is used either as a priming coat or for protection against rust and corrosion. Chief among the advantages claimed is almost complete absence of porosity. Applied by spraying, painting, or dipping, it forms a thin, flexible coating that is not affected by temperature changes to any noticeable degree. Dries quckly, can be handled in five to ten minutes after applying. Marley Chemical Co., 983 E. Milwaukee, Detroit.

Industrial Tractor Tires

Innacush tire, designed for small industrial tractors, is built with an undertread cushion of rubber to give the tire shock-

absorption properties. Non-skid in design, the tread shows gripping power on wet and oily floors and on ramps and runways. Tire size is 21x5x15. United States Rubber Co., Rockefeller Center, New York.

Electric Hand Saw

Carrying a 6½-in. diameter blade with cutting capacity of 2-in. material and weighing only 16½ lb., this saw travels at 7,200 r.p.m., producing a cutting edge speed in excess of 2 miles a minute. Desig-

Insulation Facts · Number 3.

. . . EHRET'S 85% MAGNESIA
IS DEPENDABLE PROTECTION
Those who use Ehret's 85% Magnesia can, like the tortoise, rest assured that they have dependably permanent protection. Not only is this material high in insulating efficiency and time defying in character, but it can be relied upon in practically every type of industrial service, regardless of the abuse or hazards involved.
In addition to 85% Magnesia, the Ehret Company provides insulations for all industrial requirements. There is an Ehret Contractor or Distributor in every principal city.
SAVE HEAT WITH
EHRET INSULATIONS
EHRET MAGNESIA
MANUFACTURING CO.
VALLEY FORGE
PENNSYLVANIA

MAKERS OF INDUSTRIAL INSULATIONS FOR MORE THAN 40 YEARS

MAINTENANCE DOLLAR STRETCHED 1500% TELEVISION "dag"..
..beats heat!
In "Cyclones" dag is used
The Leaders improve engine run-in with COLLOIDAL GRAPHITE
...and "dag" plays part
15 YEARS with the same bearings—at 400°F (MAX.)
Building Better Foundations for Finish
dag does double duty
SAVES 30% TO 40% IN RUNNING-IN TIME
ELIMINATES STICKING IN DEEP IMPRESSION DIES
Avoids THREAD GALLING
MAN PUSHES TONS WITH EASE
MAJOR OIL COMPANIES NOW SUPPLY "dag" COLLOIDAL GRAPHITE LUBRICANTS—
dag
REG. U. S. PAT. OFF.
COLLOIDAL GRAPHITE
scoops!

*Headlines from recent "DAG" ADS founded upon case histories—letterhead request will bring complete data.

dag REG. U. S. PAT. OFF. COLLOIDAL PRODUCTS

ACHESON COLLOIDS CORPORATION, PORT HURON, MICH.

Here are a few of the many uses of colloidal graphite in industry—check any with which you may be having lubrication difficulties.

"DAG" COLLOIDAL GRAPHITE FOR:

CONVEYORS	SCREW THREADS
FORGING DIES	STEAM CYLINDER
COMPRESSORS	CASTING
GLASS MOLD	CONDUCTIVE COATINGS
ASSEMBLY AND RUN-IN	IMPREGNATION

Tear off this coupon and attach to your letterhead—it will bring a working sample for the uses you specify.

ACHESON COLLOIDS CORPORATION • Port Huron, Michigan

nated as Type K-65, saw is equipped with a ⅝-hp. Universal motor. The base raises and lowers for depth adjustment and tilts to 45 deg. for bevels. A cast-in and enameled graduated scale afford quick and accurate setting. The Porter Cable Machine Co., Syracuse, N. Y.

Power-Propelled Industrial Truck

Powered by gas engine or electric motor, the Motorjack moves loads up to 4,000 lb. it is claimed. Built to handle racks of concrete block or other products to and from storage, it moves in any direction without the use of reverse gears. Will turn around within its overall length. L. F. Milner, 1304 Kentucky Ave., Indianapolis.

Spiral Packing

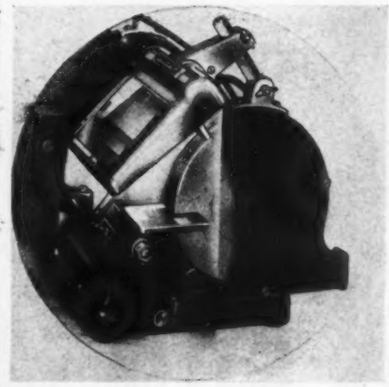
Palmetto high-pressure spiral packing is made of closely woven asbestos cloth with center block laid up against a flat strip of heat-resisting, resilient red rubber. Specially adapted for reciprocating rods and plungers of steam engines and pumps, air and gas compressors, and various special machinery. Furnished in standard 12½ foot spirals. Greene, Tweed & Co., 101 Park Ave., New York.

Return Idler

Rubber-tread idlers for supporting the return run of 14- to 60-in. wide belt conveyors. Each idler consists of from 4 to 12 6-in. diameter rubber-tired rolls suitably spaced and mounted on a roller-bearing-equipped steel tube that will fit into the same hangers as the regular return idler roll. Specially recommended for conveyors handling corrosive, abrasive, wet, or sticky materials. Link-Belt Co., 307 N. Michigan Ave., Chicago.

Eye Shields

A Flud-Lite eye shield, suitable for use on all grinders. Fitted with two bayonet type light bulbs, it throws light directly



on the grinding wheel and work. The design and lighting arrangement provides unusually high visibility for the operator, it is claimed. Adjustable up or down; cannot, however, be moved to a non-guarding position without dismantling.

Frame is a sturdy die casting, aluminum finished, and holds two sheets of glass, 4x6 in.,—a piece of safety glass with ordi-

FOR PRODUCTION INSURANCE

buy Westinghouse

TIME SAVERS FOR INDUSTRY

WESTINGHOUSE COMBINATION LINESTARTER

For Motor Control and Circuit Protection

CLASS 11-206

Magnetic motor starter—motor-circuit switch—motor overload protection—nofuze circuit protection—all in one unit. Bi-metal gives permanently accurate overload protection. "De-ion" quenchers protect contacts—save maintenance. Four-in-one Unit saves installation time—saves space—saves wiring—provides greater protection for operators.

WESTINGHOUSE "DE-ION" MOTOR WATCHMAN

Manual Across-the-line Starter for Motors up to 7½ hp.

CLASS 10-100

Quick-make, quick-break toggle action prevents "teasing" contacts. "On," "Off," "Tripped" positions self-indicating. Bi-metal disc overload protection. "De-ion" protection for contacts. Ample wiring space. Rust-resisting parts. Silver contacts. Keyhole mounting for quick, easy installation.

WESTINGHOUSE SAFETY SWITCH

For Circuit Protection

Diamond-pointed break jaw and extended-blade construction prevent burning and beading of contacts. One-piece copper construction saves money by preventing power loss. Quick-make, quick-break on Types A and C. Ample space for wiring. Solderless lugs. "De-ion" arc quenchers on 575-V switches.

WESTINGHOUSE AB-I BREAKER

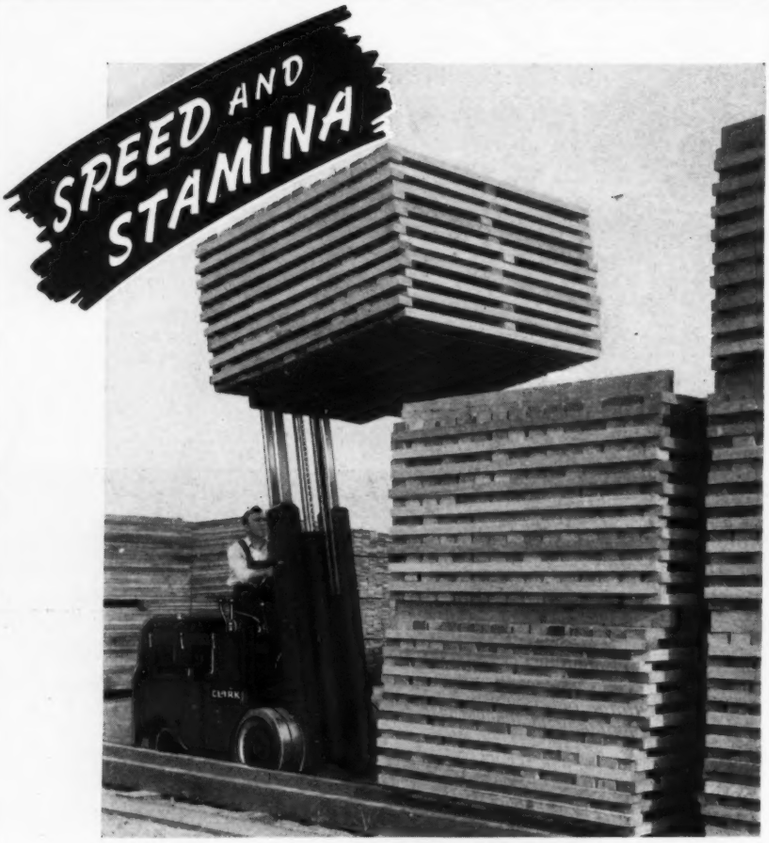
For Circuit Protection

Eliminates switch and fuses. Bi-metal overload protection. "De-ion" protection for contacts. Saves maintenance time and production time—circuit outages can be restored by operator. No live parts exposed. Door opens only when switch is in "Off" position. Occupies approximately 40% less space than switch and fuses.

Call your nearest Westinghouse Sales Office or Distributor

Westinghouse

MOTORS AND CONTROL



"Clark" Fork Trucks tier 3-ton loads to 104 in. in 15 sec.—higher if necessary. They travel, loaded, at 1 to 7½ m.p.h., climb ramps, turn around in a box car.

"CLARKS"

are swift, powerful, always ready to start, will work 24 hrs. around the clock without faltering and will move goods at *lowest cost per ton-mile.* Write for catalog—Fork Trucks, Platform Trucks, Dump Trucks, Power Shovels, Tractors—over 70 models.

"Clark" Industrial Tractors—3- and 4-wheel models—haul up to 85 tons on trailers.

CLARK TRUCTRACTOR

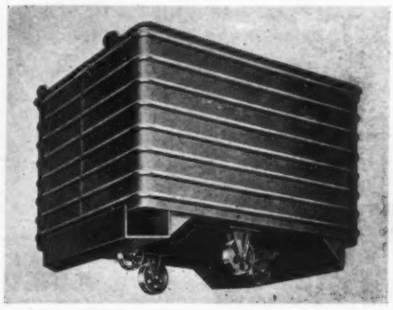
Div. of Clark Equipment Co.

116 SPRINGFIELD PLACE ● BATTLE CREEK, MICH.

nary window glass beneath, which is easily replaced if it becomes pitted with emery dust. Stanley Electric Tool Division, New Britain, Conn.

Dump Box

A corrugated steel box, designed especially for use with lift trucks equipped with revolving type forks, has recently been introduced. Special fork pockets are welded to the bottom at either end and run the full length of the box. When the forks are inserted in these two pockets the box can be lifted, turned completely over



for dumping, then righted again. Top flanges of box can be equipped with tiering or crane lugs for efficient storage and handling. Casters facilitate short spottings and permit box to be moved easily between machines. Suitable for handling scrap, small metal parts, castings, and various loose materials. The Union Metal Manufacturing Co., Canton, Ohio.

Gas Economizer

Model 4360 Rego gas economizer for use where welding operations are intermittent, and torches are on and off due to work set-ups. Designed for light-weight torches and torches which operate at unbalanced gas pressures as extreme as 3 oz. acetylene pressure with 50 lb. oxygen pressure. Shut-off valves on lever arm assembly equipped with adjusting screws which assure correct seating. National Cylinder Gas Co., 207 West Wacker Drive, Chicago.

Patching Material

Quick-Patch is a ready mixed material for patching holes, spalls, and worn expansion joints in concrete. It is claimed that repair patches take only one minute, can be made during working hours without interruption of plant operation, and are not injured by truck traffic while installing; and that they will handle any weight load and provide a low traction, permanent floor repair. May be used in or outdoors. Dura-Tred Company, Department B., 3508 Carroll Ave., Chicago.

Abrasive Mask

No. 602 Healthguard abrasive mask has been tested and approved by the U. S. Bureau of Mines. Adapted to operations in which dusts of intense or lesser density are encountered during periods of extensive exposure. Mask consists of a soft molded rubber facepiece with large replaceable laminated glass lenses, head harness and corrugated tube, filter unit

STEEL MEN SAY, "We will do the job"

by Lowell Thomas

It all starts like this. Above—A giant ladle pours 100 tons of molten pig iron into an Open-Hearth Steel Furnace.

•

Left—Investment for the Future. One of Steel's 2,550 research men looks through a metallurgical microscope.

WHAT about defense? When I left New York for the Front—the Front of Steel—in Pittsburgh and Ohio, the words of Ben Fairless were still echoing in my ears, "Never mind the alarmists. *Steel will do the job.*"

But I was a little bewildered—maybe even a little skeptical, even though Fairless is President of U. S. Steel and ought to know.

After all, I am not an economist. I am not even a steel man. I have, like most Americans, a complete faith in native American ingenuity and "drive." But I had talked to men in Washington who told me steel "did not have nearly enough capacity to meet normal demands plus the needs of National Defense."

This was before the Gano Dunn report had been made to the President—the official report which said that we will have enough of most kinds of steel, both for war and commerce, even if the national income climbs to 90 billion dollars. (Last year it was 74 billion plus.)

Then, of course, there's always the "labor-question"—Yes, it's just one word the way people use it. But there wasn't any "laborquestion" when I was going through the Armco plant (American Rolling Mill Co.) at Middletown, Ohio, the next morning. There were just some Americans, most of them in the kind of fine physical condition that makes office workers and radio broadcasters envious. And these Americans have, I assure you, got what it takes. It's in the atmosphere all around them. They have morale. They have that something that can't be faked. It's what Wavell's British Army had in North Africa and what Graziani's army (twice as big) just didn't have.

We stopped to look at a pile of stainless steel sheets ready for shipment to the Navy. Each sheet was covered with a soft, fluffy layer of paper and then with a layer of brown wrapping paper. I asked the nearest steelworker if we could have a look.

Have you ever gone into a really crack artillery regiment and asked to inspect a fieldpiece ready for action? I have. And the man who opens the spotless, perfectly oiled breechblock for you will pack plenty into that gesture. He will pack into it pride. He will pack into it something very close to love. He will, finally, actively resent even the shadow of a criticism of that gun. He will fight *for* that gun as well as with it.

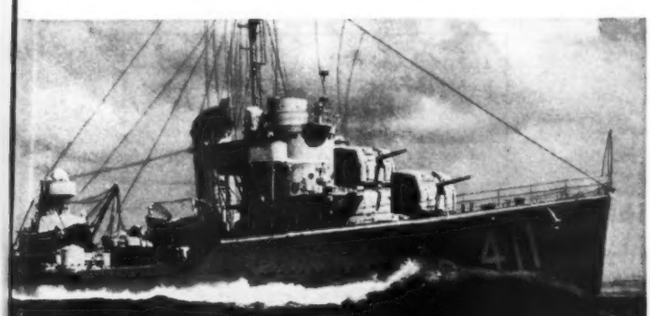
Well, Joe Stouras, ex-football player, husband, father, steelworker of Middletown, Ohio, lifted the paper layers off the top sheet of stainless steel. The man going through the plant with me was filling his pipe . . . One crumb of tobacco fell on the mirror-like surface of that sheet of steel—just one crumb.

Joe Stouras reached out and brushed it off with his middle finger—brushed it off with decision, with a trace of rebuke, with a fine protective gesture of defiance.

"This here order's going to the Navy tonight," he said. "Got to be careful."

Joe Stouras is typical of the men of steel

(*Continued on next page*)



DD411, the U. S. S. ANDERSON, knifes through the water of Penobscot Bay on her full-speed trial run off the coast of Maine. This destroyer was built and delivered to the Navy in advance of contract requirements. The U. S. S. EDISON, referred to in this article, was completed four and a half months ahead of schedule.

A note to the readers of *Factory Management and Maintenance*

The article reprinted here appeared, as Johns-Manville paid advertising, on pages 85 and 86 of the May 24th issue of the *Saturday Evening Post.* It is the first of a series by well-known writers on the defense achievements of the major industries of the country.

Because of our long and close association with these industries, Johns-Manville knows, at first hand, the job which Industry, under free enterprise, is doing in building National Defense. But we are convinced that too few people realize the magnitude of that job and, like many other manufacturers, we believe it is vitally important to the future of the American System that this story be told to the widest possible audience.

It is our sincere hope that this series in the *Saturday Evening Post,* and a similar campaign which is appearing in newspapers, will be helpful in informing the public of the indispensable job American Industry is doing in this time of our greatest National Emergency.

JOHNS-MANVILLE

This is one of a series of advertisements sponsored and paid for by Johns-Manville. For over 80 years this company has been serving America's basic industries.

How indispensable these industries are to the American way in time of peace is generally recognized. This series is to help inform the public of the indispensable job these industries are doing in this time of great National Emergency.

Johns-Manville is proud of the contributions its products are making in helping steel, as well as other industries, produce defense material quickly and at the lowest possible cost.

JOHNS-MANVILLE

WHAT STEEL MEN SAY

(Continued from preceding page)

to me. Men who are keeping open hearths and blast furnaces running 24 hours a day (three eight-hour shifts). Men who, when an order is posted on the bulletin board marked "National Defense," just "high-tail it into the shop," as one assistant works manager put it to me. And they are American craftsmen, fully aware of the fact that poor quality, just a slight flaw, in armor plate, airplane frame or Navy searchlight reflector may cost an American or British life somewhere, sometime. They know, almost all of them, what Joe meant when he said, "Got to be careful."

I say "almost all of them," because no honest reporter can deny the existence of some unrest, of some disloyalty, even of some sabotage. But, in the words of Irving S. Olds, Chairman of the Board of U. S. Steel, "All but a few of the workers throughout the industry *want* to do the job. And the minority, although they can make trouble, cannot buck that majority's determination to do the job on time—even ahead of time."

Mr. Olds can show you what he means with deeds, not words. He knows; the Government knows; and every American *ought* to know that two destroyers completed last summer by The Federal Shipbuilding and Dry Dock Company, U. S. Steel's shipbuilding subsidiary, were delivered *seven months* ahead of contract requirements . . . The U. S. S. EDISON, one of that company's more recent deliveries, was completed ten and a half months after the keel was laid—4½ months ahead of the contract delivery date.

Can American private enterprise do the job? "Yes," say the men of steel. And they say it with a full-throated voice that will be heard from Bethlehem to Berlin.

Steel is an industry vast in its five-billion-dollar investment; immense in its giant plants and huge machinery, and tremendous in its man power—half a million workers who "bulk big" in stature, a wide-shouldered, thick-thewed multitude, confident of their strength and skill, proud of their trade. And from executive offices to timekeepers' windows, from blast furnace to finishing mill, my tour of steel seemed tuned to the rhythm of an exultant, irresistable drive for national defense.

This drive starts full-powered because during the long doldrums of the depression, here is a private enterprise that spent a billion and a half dollars increasing its capacity in the face of diminishing returns. Because management believed in an expanding America and discounted the idea of a "static economy," the steel industry increased the annual capacity of their plants from sixty-five million tons in 1929 to eighty-five million tons in the somber year of 1940.

Yes, the steel industry is big enough and strong enough, but is it flexible enough?

The Boys Were Cold

An incident told me by Charles Hook, President of the American Rolling Mills, will, I think, answer that.

"On December 5th," said Mr. Hook, "a government man called me up from Washington. 'The boys in the Tennessee camps,' he said, 'are shivering in unheated tents. We are ordering several thousand camp stoves from the Tennessee Enamel Manufacturing Company. I understand you furnish their sheet steel. What kind of priority order do you need?'

" 'We don't need any,' I said. 'Order your stoves and leave the rest to us.'

"We called Tennessee and learned the sizes they needed. We supplied most of them from stock. Within a week we had shipped the sheets—250 tons of them. Inside of ten days from the Washington phone call, the boys in the draft camps were snug in their heated tents."

That is flexibility—and it is also speed.

The twenty million tons of steel needed by John Bull and for Uncle Sam's defense is regarded by steel men as no vast amount. Yet this is greater than the total production of any other nation save Germany. And except in relation to our total 85,000,000-ton capacity, it *is* an enormous volume of steel. It will take half a million cars to ship it, and they would make a freight train six thousand miles long.

And it isn't, of course, mere bulk and weight like coal and ore and limestone. It is in thousands of shapes and sizes, from rough ingots to stainless-steel needles for hypodermic syringes, and from eighteen-inch armor plate to sheets that are used in making plane generators—sheets so thin you can typewrite on them. With all its multiplicity and complexity, steel is being fabricated on schedule and delivered on time—whether it's 100 tons for hobnailed shoes, fifty thousand tons of structural steel for a new tank factory, or fifty pounds of tiny, microscopically finished steel springs for the innards of a torpedo.

The men of steel, from top to bottom, don't talk much. They're too busy getting the job done. I left the office of one prominent steel executive late on a Friday afternoon with a mountain of work on his desk high enough to chain him there until Sunday night. There is no "weekend blackout" in steel, for management or labor.

Director General of Production Knudsen said last January, "If we are willing to spend a little sweat for a year or so, then we may be able to save a little blood later on." Steel is spending sweat, right now. In the plant, and in the offices, far into the night. And in the laboratory. Research is, in truth, the universal ingredient that goes into every "heat" in steel's furnaces, and enters into every process from the ore and coal mines to the ultimate consumer. Only in the chemical industry does the laboratory function so incessantly and microscopically as in metallurgy.

And in no other business is the research equipment so varied and so expensive. It ranges from scales that will weigh a wisp of mist to machines that will pull a one-inch tool-steel bar apart. Research is responsible for the development of every high-speed steel and every alloy that gives the machine age its infinite variety. Research, for example, reduced the weight of airplane engines from the twenty-one pounds per horse power of the Wrights' *Kittyhawk* to the one-pound-per-horsepower of a modern motor. If only I were at liberty to tell you about other, and even more amazing, achievements I saw or heard about "behind the scenes."

Then, of course, I asked executive after executive, "Are there any bottlenecks in steel?" They answered this way: "All steel needs is to know what is required for defense. We'll find a way to take care of it."

Here, for example, is one way they deal with shortages. If any one alloying agent, molybdenum, tungsten, chromium or vanadium, becomes scarce, steel's research staffs find means of substituting and shuffling them about to get the same results by different combinations. Steel companies' scouts are always finding new sources of supply for their engineers to develop.

Perhaps I ought to break in here, and explain that there is, in steel, no disposition to belittle the importance of governmental authorities in the vast panorama of steel. Steel men contend only that the most efficient and satisfactory functioning of the tremendous defense machine results when government leaves actual operations to the ingenuity, initiative and adaptability of men educated in a competitive school of change and progress.

Those qualities can respond to sudden stress with the resiliency of a fine steel spring. Less than a year ago, steel executives sensed—long before an emergency developed—that electric-furnace capacity was not adequate to future requirements. Only 1½% of steel production comes from these furnaces, but that small per cent comprises nearly all the fine steels for high-speed machine tools, airplane engines and instruments, and bomb and gun sights. Today electric-furnace capacity is fifty per cent greater than that of early 1940 and further increases are keeping in step with defense demands.

In my search for the facts, one of my most valuable sources proved to be W. S. Tower, President of the American Iron and Steel Institute and Ambassador of Steel to the United States Government. The Institute has a membership of more than 90 operating steel companies and performs an indispensable function in making it possible for these vast enterprises to operate as one great industry in National Defense. Mr. Tower's confidence that steel can do the job is not based on hope, but on a great volume of hard, cold statistics he has constantly at his fingertips.

A New Crop of Millionaires?

"—And how about a new group of multi-millionaires?" I asked Mr. Tower. "Is rearmament going to make us any?" "Not in steel," said Mr. Tower. "For big figures no longer mean big *profits*. Steel is a *five-billion-dollar* business. . . That's how much capital (savings) is invested in it. But for the past ten years, it has earned only an average of 2% on that investment.

"As for this year, well, steel is spending $282,000,000 for plant expansion and equipment, for one thing. For another, steel, right now, is employing 20 per cent more men than in 1929."

"And what about the men of that steel army?" I asked.

"Hourly wages in steel today are nearly 50% higher than in 1929. Also, between 1926 and 1939, the average severity of accidents was reduced 35%. One out of every three severe accidents that used to happen doesn't happen any more."

TO SUM UP:—It seems to me that this titan industry is demonstrating its fitness for a titanic task. It has the scientific management, the skilled workers, the materials, the capacity and the production.

Somehow the roar and rumble of the mills and forges, the hiss and crackle of molten metal, the blast of furnaces and converters, mingle in one sound, and that sound is the Voice of Steel.

Winston Churchill said, "Give us the tools, and we will do the job."

The Voice of Steel can say, for its part in the defense program, "We *have* the tools, and we will do the job."

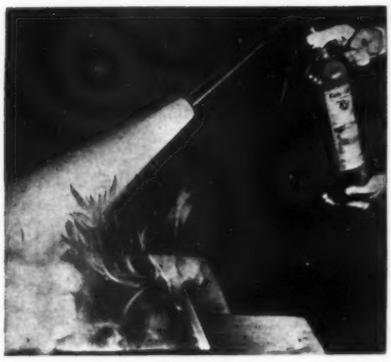
This is the first of a series of advertisements sponsored and paid for by* Johns-Manville *and designed to tell the American people how indispensable our basic industries are for National Defense.

— JOHNS-MANVILLE —

with replaceable cartridge, air regulating valve, pressure relief valve, quick acting detachable coupling, and hose which connects it to the air supply. Chicago Eye Shield Co., Dept. 44, 2362 Warren Blvd., Chicago.

Fire Extinguisher

Speedier firefighting operation, it is claimed, has been added to the Kidde-Lux Model 4 extinguisher by the addition of a trigger control valve. Extinguisher is dis-



charged by simply pulling a trigger which permits the extinguisher to go into action faster, and also assures no wasting of the carbon dioxide gas while the operator is maneuvering around the blaze. Walter Kidde & Co., Inc., Bloomfield, N. J.

Cam-Operated Controllers

Extreme ease of operation with positive feel of all speed positions by the use of an adjustable compression type of star wheel spring is claimed for this mill duty controller. Available in 2-, 3- and multi-speed types for mill auxiliaries, crane hoist, bridge, and trolley applications. Cutler Hammer Inc., Milwaukee.

Fan

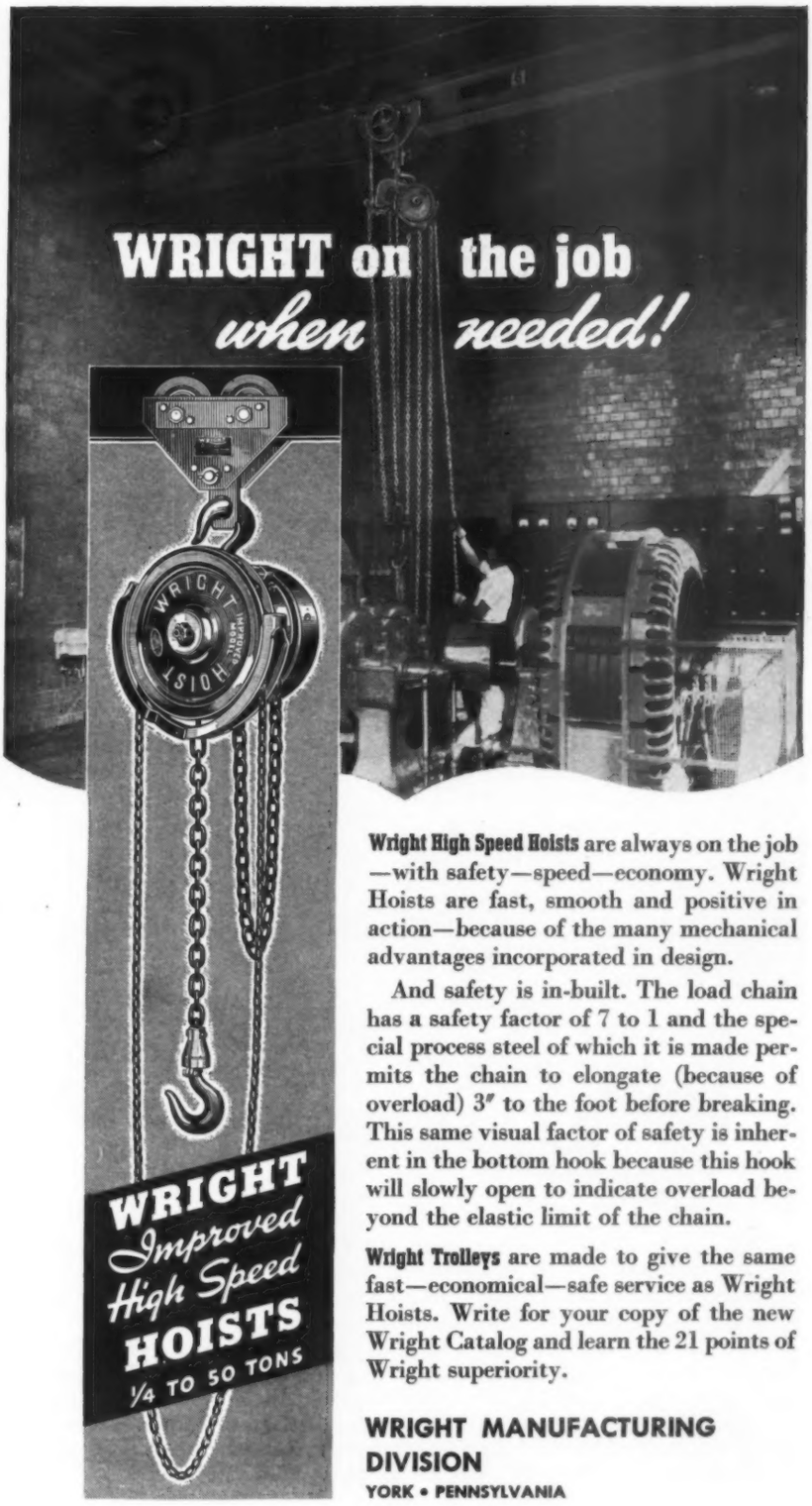
Heavy duty 36-in. portable floor fan. Provides relief to workmen in areas of intense heat. Circulates air at a rate of 24,000 cu. ft. per min. Propeller is four-bladed. Can be safely moved on scoop truck, and has hook so that it can be moved by crane. Ilg Electric Ventilating Co., 2850 N. Crawford Ave., Chicago

Respirators

The manufacturer of Dupor twin-filter respirators has replaced all aluminum parts with plastics, including all valves, gromets, screw connections. Other changes include clip-on devices and handy slide fasteners for adjusting band to any head size. The entire respirator can be dismounted for cleaning, and it is slightly lighter. H. S. Cover, South Bend, Ind.

Floating-Shaft Coupling

The floating-shaft flexible coupling designated as L-R Type HKQ is applicable to either horizontal or vertical drives, where the space between the driver and driven units cannot be successfully handled by standard couplings. The floating shaft is supported in fixed bear-



Wright High Speed Hoists are always on the job —with safety—speed—economy. Wright Hoists are fast, smooth and positive in action—because of the many mechanical advantages incorporated in design.

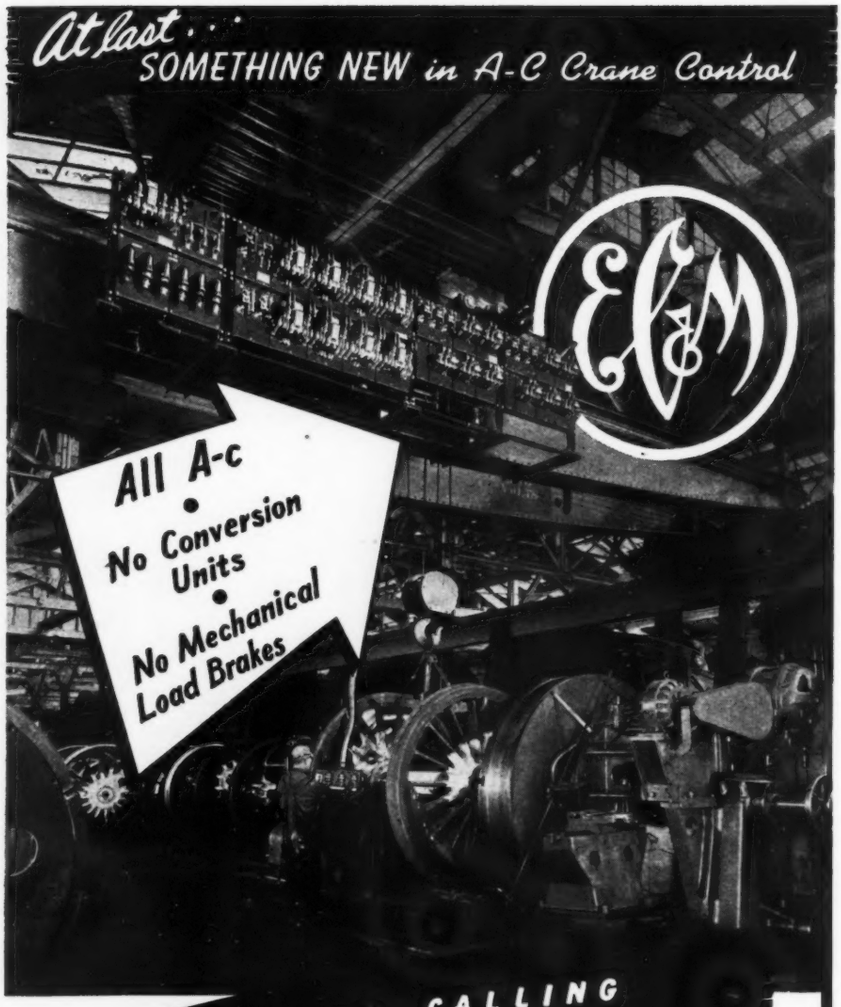
And safety is in-built. The load chain has a safety factor of 7 to 1 and the special process steel of which it is made permits the chain to elongate (because of overload) 3″ to the foot before breaking. This same visual factor of safety is inherent in the bottom hook because this hook will slowly open to indicate overload beyond the elastic limit of the chain.

Wright Trolleys are made to give the same fast—economical—safe service as Wright Hoists. Write for your copy of the new Wright Catalog and learn the 21 points of Wright superiority.

WRIGHT MANUFACTURING DIVISION
YORK • PENNSYLVANIA

Let Wright engineer your hoisting and crane problems. Work through your local Wright distributor. You'll find him listed in the classified telephone book.

AMERICAN CHAIN & CABLE COMPANY, Inc.
In Business for Your Safety



ON A JOB CALLING FOR PRECISION HANDLING

YOU, too, can protect extremely valuable machine tool centers and enable your operator to guide the work carefully into position with an EC&M A-c Dynamic Lowering Frequency Relay Magnetic Hoist Controller.

Within practically the first year of announcement nearly 100 of these hoist controllers have been ordered for new and old cranes. Users report spotting as close as 1/32" easily done. If you have an A-c crane or are considering the installation of one, put it under control of EC&M Frequency Relays and LINE-ARC Magnetic Contactors. Ask for Booklet 930.

THE ELECTRIC CONTROLLER & MFG. COMPANY
2700 E. 79th Street Cleveland, Ohio

Please send A-c Magnetic Controller Booklet 930

Name.....

Address.....

MOTOR CONTROLS • BRAKES • LIMIT STOPS • MAGNETS

ings. A feature is the speed which the coupling can be disassembled, requiring merely the reversal of 3 to 5 driving bolts, without disturbance of cushions or connected units. Made in standard sizes, with bores from 1½ to 8½ in. (7 to 800 hp. at 100 r.p.m.) for various distances between fixed shafts. Lovejoy Flexible Coupling Co., 5009 W. Lake St., Chicago

Electric Etcher

An etcher for marking small tools and parts, Thin Line writes with a fine line, burning the mark, identification number, or name into the metal. Is held and used as if writing with a lead pencil. Complete unit includes 9 ft. primary lead and plug, 2-oz. heat resisting hand piece with 3-ft. lead, 4x6 in. work plate, 115-volt, 50–60 cycle standard. Other voltages and frequencies available. Ideal Commutator Dresser Co., 1416 Park Ave., Sycamore, Ill.

Protective Ointment

Ply No. 6 is an ointment that is applied over the exposed part of the skin, leaving a thin white film which does not interfere with the efficiency of workers. For prevention of skin disorders caused by contact with acids and caustic compounds in either dry or wet form. It is estimated that a pound of the ointment will last from four to five months, under average working conditions. Is easily removed with ordinary soap and warm water; and is harmless to the skin. Milburn Co., Detroit

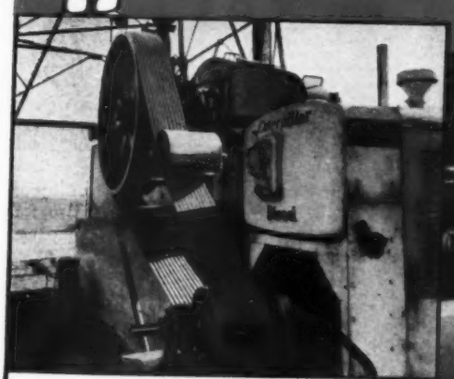
Explosion Proof Water Cooler

For Class 1, Group D, hazardous locations, such as oil refineries, paint factories. Available in three models, these coolers have standard stainless steel tops, heavy steel bodies, and hermetically sealed condensation units. Capacities are 8.2, 9.8 and 18.9 gals. per hour of water

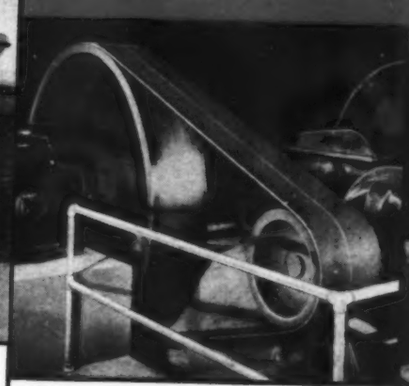
Gilmer BELTS

Let Gilmer engineers belt your drives . . . . . for power savings and increased production

Gilmer provides an engineering service that will help you cut power costs and achieve greater output from your belt-driven equipment. Gilmer engineers can assist you in designing more efficient drives, in the selection of the best belt for each transmission purpose, and in plant surveys of belt requirements to save you time and money in ordering. Ask your Gilmer Distributor for details, or write us today.



1. These Gilmer V-Belts operate an oil pump with high efficiency because their normalized cord construction assures minimum stretch and slippage.



2. This 15" endless Gilmer Kable Kord eliminated an idler, shortened center distance. Kable Kord is built on the contactor-belt principle—one belt for grip, one for pull.

3. Light, sturdy, fast and flexible, this Gilmer RHO Endless Belt is oil and heat resistant, lasts longer in small pulley service and seldom needs take-up.

4. Gilmer Speedage Fabric Belts, like this one, run smoothly at such high speeds as 10,000 f.p.m. and over. No lap or splice to cause vibration.

GILMER BELT SELECTOR—SUPPLEMENT

Plant Application	Belt Recommended
5. Where endless V-Belts are impractical because of obstructions.	Gilmer Streamliner V-Belting
6. High speed precision drives to about 9000 f.p.m., small pulley diameters; no vibration, long life.	GILMER-HEVALOID Endless Belts
7. General flat pulley service where low first cost is main consideration.	Gilmer Standard Cut Edge Belting
8. Round belt drives—mule, serpentine, quarter-turn spindle, cross-drive—on small machinery.	Gilmer Round Endless Belts
9. Special fabric belts, for special flat drives and light conveyor applications.	Gilmer Cotton Web and Duck Belts

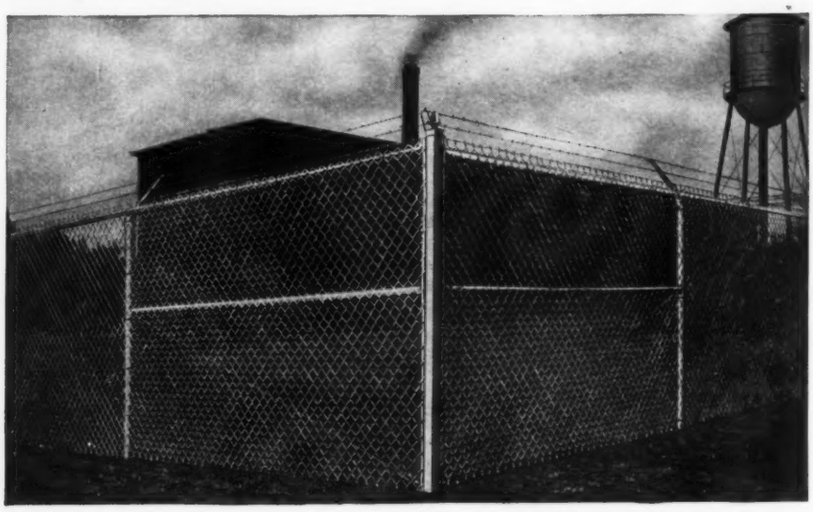
Besides, Gilmer specializes in manufacturing belts and belting for specific industrial uses such as Planer, Spinner, Cone, Gainer, Tube-Winder, Stemming-Machine and Sander Belts. Oil resistant construction can be furnished on most of these belts. The Gilmer Engineering Department will gladly make recommendations.

L. H. GILMER COMPANY
TACONY, PHILADELPHIA, PA.

"The right transmission belt for every purpose"

PROTECTION becomes a "MUST"

WHEN PLANNING DEFENSE PRODUCTION



And Complete Protection Calls for

1. AN ANCHOR FENCE AROUND YOUR PLANT

2. ANCHOR FENCE ENCLOSURES INSIDE

Outside and *inside* protection are BOTH necessary today to ensure "on-time" production of Defense Orders. For spies and saboteurs are seeking every opportunity to delay Defense work and steal Defense secrets. A strong, sturdy Anchor Fence around your plant provides protection against outside sabotage agencies. And Anchor Fence enclosures *inside* your plant, around power stations, transformer installations, chemical, fuel and raw material storage prevent all except your most trusted employees from reaching vulnerable points. An Anchor Fence can be quickly installed, with our exclusive "drive anchors" which keep it permanently in line in any type soil. It can be moved without loss in case of plant expansion. Send for the Anchor Engineer. He'll give you the benefit of Anchor's years of experience in fence protection—explain our Nation-wide Sales and Erecting Service—show you how to provide effective plant protection with a minimum of expense for guards and policing.

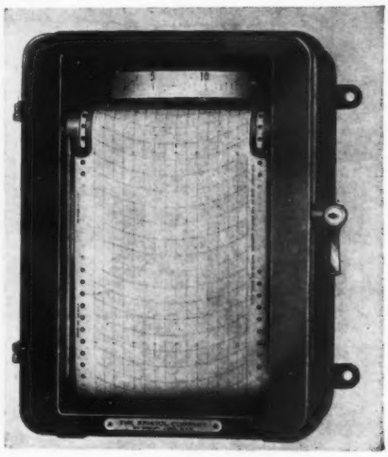
AN ANCHOR FENCE ENGINEER will gladly help you plan complete protection for your plant. Write or wire today to: ANCHOR POST FENCE CO., 6620 Eastern Ave., Baltimore, Md.

YOUR BEST DEFENSE IS AN ANCHOR FENCE

cooled from 80 deg. to 50 deg. F. Cycling control mechanism and overload protective devices are inclosed, making the coolers explosion proof as no arcing can develop in the cooler to ignite explosive mixtures in the air. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Strip-Chart Recorders

Available for recording on a 6-in. strip chart: d.c. volts and millivolts; d.c. amperes and milli-amperes, pressure, liquid level, flow, temperature, motion. Also for remote recording. The Bristol Company, Waterbury, Conn.



Pallet Stacker

Transporting pallet stacker for handling materials shipped or stored on double-faced pallets. Running gear permits operator to approach stacker to pallet and throw lever, braking the wheels; to continue pushing stacker while wheels remain stationery, stacker arms going into the upper pallet and base member into the lower pallet (the wheel base is now 19 in. instead of 52 in.); to turn crank and raise load about 6 in. to pull stacker towards him, which returns stacker wheel base to its normal 52 inches. Over-all height allows entrance to freight cars. Large floor wheels give ample under-clearance for sills or ramps. Lewis-Shepard Sales Corp., 245 Walnut St., Watertown, Mass.

Perspiration Retainer

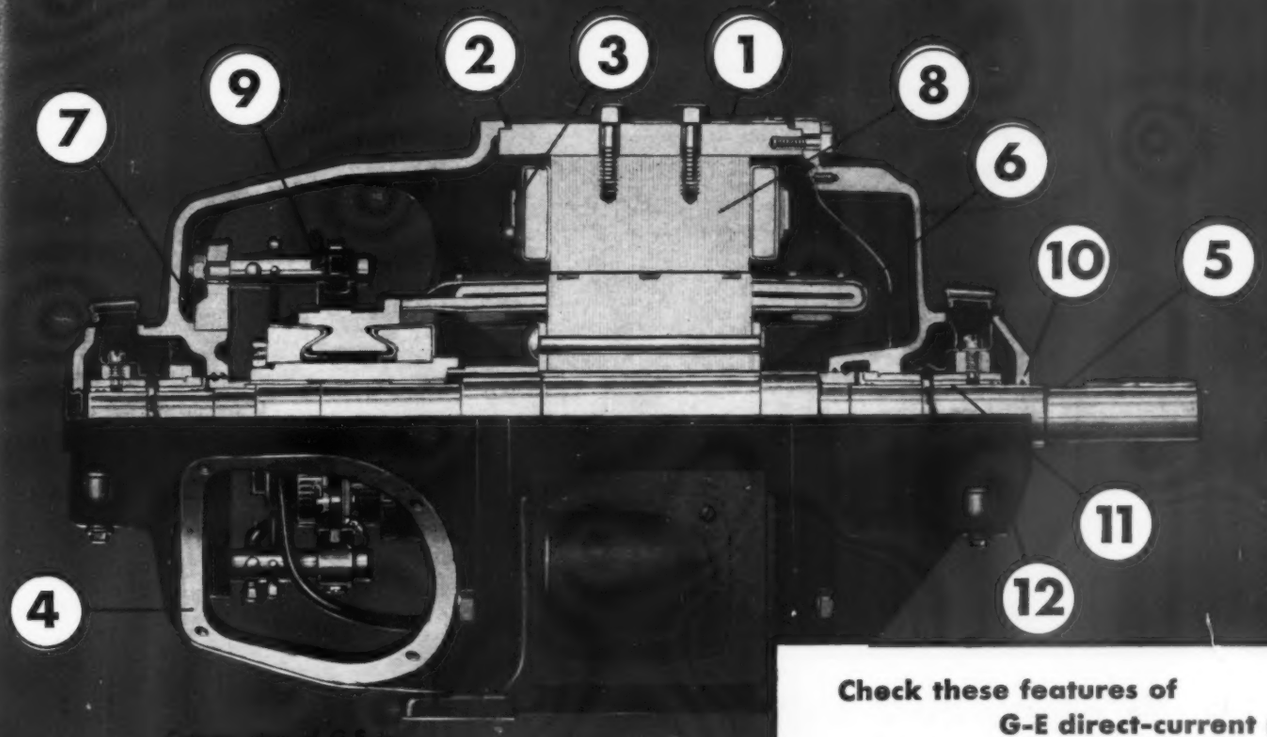
Coolband betters hot working conditions by preventing sweat in the eyes and on goggles and glasses. Consists of a soft, flexible band which encircles the head, clinging without binding, and creating a cooling effect through constant absorption. Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh

Paging System

Designed for use in factories, warehouses, transportation terminals, and offices, for making announcements of general interest, paging individuals, and so on. Operation is from 110 volts, 60 cycles, a.c. The amplifier which delivers 30 watts of usable power will handle 4 or more

INSIDE FACTS

Why G-E direct-current motors give long, low-cost service



Cutaway view of G-E industrial-type d-c motor

SEE for yourself that there's no mystery behind the excellent performance of G-E industrial-type d-c motors.

No mystery—just facts—facts about their design and construction that show why they give years of dependable, low-cost service wherever they're installed. Take a minute and check these facts, remembering that because of space limitations they form only a partial list.

Long bearing life, excellent commutation, a highly protective insulation with remarkable bonding qualities, easily accessible brush rigging, a convenient lubrication system—you find all these advantages in G-E d-c motors.

Remember, too, that these motors are available in a wide variety of standard ratings, speeds, and enclosures to meet all operating requirements. For complete information, just get in touch with the G-E representative nearest you. General Electric, Schenectady, N. Y.

Check these features of G-E direct-current motors:

1. Rolled-steel frame, bored throughout its length, assures uniform air gap and maximum strength.

2. Substantial, 360-degree rabbet fit maintains accurate concentricity and alignment of end shields.

3. Series windings outside shunt, resulting in a better-insulated coil. G-E bonding varnish cements the coils into a solid mass. High resistance to foreign matter prolongs the life of the winding.

4. End-shield openings can be covered with flat plates or screen covers, for which tapped holes are provided.

5. Shaft removable (5 hp and larger).

6. Form-wound, pretreated coils (except 2-pole motors).

7. Brush yoke clamped in position and easily adjustable.

8. High-grade silicon-steel laminations.

9. Brush holders easily adjusted to maintain proper setting.

10. Grease-filled V-grooves exclude dust and dirt.

11. Steel-shell, babbitted bearing linings.

12. Large oil reservoir.

GENERAL ELECTRIC

STILL ANOTHER NOTED PLANT PARTITIONED with J-M TRANSITE WALLS

Movable, asbestos-cement partitions selected for offices in The Stanley Works, New Britain, Conn.

IN THE STANLEY WORKS, as in scores of other well-known industrial plants, J-M Transite Walls are proving why they are particularly adapted to factory use.

Made of asbestos and cement, these modern asbestos-cement partitions offer every advantage of both fixed and movable walls. They are unusually durable . . . fire-retardant . . . assure continued low maintenance. Offices are solid and completely private. Yet, because of the simple construction method employed, installation time is far less than that required for masonry walls. And when offices must be altered or moved from one section of the plant to another, this same construction method means rapid changes . . . full salvage of materials.

Transite Walls are available in two types, Imperial and Universal. For full details on both, write for brochure TR-22A. Johns-Manville, 22 East 40th Street, New York, N. Y.

JM Johns-Manville
TRANSITE MOVABLE ASBESTOS WALLS

8-in. P.M. dynamic speakers. Controls are provided for regulation of output power and tone. Allied Radio Corp., 833 W. Jackson Blvd., Chicago.

Safety Fitting

On the Ermeto safety fitting, claimed to be suited for use with tubing of all metals, the cutting edge of a hardened ring shears a groove into the outer surface of the tube, making a leak-proof joint that cannot be pulled apart. No flaring, threading, soldering, or welding is necessary. Connections can be taken apart and remade without affecting the tightness of the joint. Available as nipples, connectors, unions, elbows, tees, and sleeves for tube diameters from ¼ in. to 1½ in. O.D. Weatherhead Company, Cleveland

Industrial Reflectors

Two and three lamp RLM fluorescent lighting units can be used with white or daylight lamps. Available for chain suspension, conduit suspension or close-to-ceiling mounting. For 48 in., 40 watt fluorescent lamps. For 60 in. 100 watt lamps a RLM diffuser unit is available, with or without apertures. Wheeler Reflector Co., 275 Congress St., Boston

Kickless Cable

Kickless welding cables of "full concentric" design for reduced current loss and with positive and negative current strands wound at steep helical angles to increase ease of flexing and reduce wear. P-H cables available in complete range of capacities. Can be ordered with almost any terminal for welding guns of standard make. Progressive Welder Co., 3050 E. Outer Drive, Detroit

Thin Hex Nuts

For use on shear bolts where a high degree of the stress is lateral. Self-locking action by a vulcanized fiber collar built into head of nut. Available in steel, brass, and aluminum. Complete range of standard sizes, coarse and fine thread. Elastic Stop Nut Corp., 2332 Vauxhall Rd., Union, N. J.

Man Cooler

Hy-V air jet, designed for reducing fatigue of workmen in foundries, forge shops, and steel mills—any workers who are exposed to radiant heat from ovens, furnaces, forges, and molten metal. Is column mounted and adjustable to blow

KOOLSHADE*

SAVED US A COOL $4,000 ON OUR AIR CONDITIONING

...says Plaza Hotel Owner

The Plaza Hotel, Corpus Christi, Texas . . . All guest room windows on sun exposures equipped with KOOLSHADE Sun Screen.

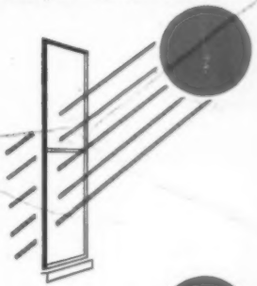
When it was decided to air condition the Plaza Hotel guest room floors, the engineers recommended that the job should be figured two ways: with inside Venetian Blinds and with KOOLSHADE Sun Screen.

"The result," stated Mr. Jack White, owner of this and other leading Texas hotels, "was just like finding $4,000, for the enormous reduction in sun load by KOOLSHADE enabled us to save $4,000 on the equipment installation, compared with Venetian Blinds. And, according to conservative calculations, our operating expenses will be reduced by $45 per month."

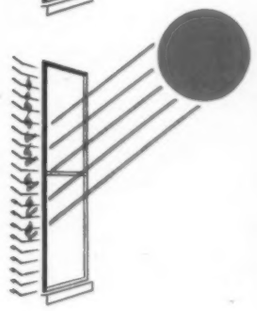
Your plant may not have Air Conditioning—but you CAN have the new comfort of KOOLSHADE "SUN CONDITIONING". Simply by shutting out the sun heat, KOOLSHADE keeps rooms as much as 10° to 15° cooler even on the hottest days—and kills sun glare too. Try it on one office and see for yourself!

COMPARATIVE FIGURES FOR TYPICAL FLOOR, PLAZA HOTEL

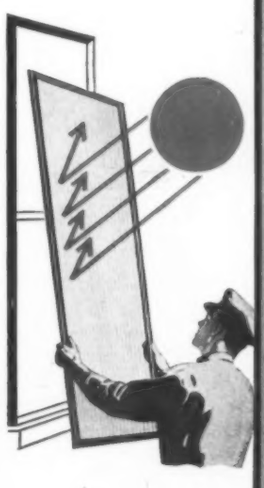
WITH BARE WINDOW, SOLAR LOAD equivalent to 4.51 TONS per floor



WITH VENETIAN BLINDS, SOLAR LOAD equivalent to 2.79 TONS per floor



WITH KOOLSHADE SUN SCREEN, SOLAR LOAD equivalent to 1.07 TONS per floor



KOOLSHADE Sun Screen is a fine-mesh bronze fabric, made like a tiny Venetian Blind so it stops sun heat rays *outside* the window. Installed like an ordinary screen—and keeps out insects, too.

• *There are* KOOLSHADE *Sun Screen Distributors in all principal cities, with competent representatives ready to counsel with you on problems of application, framing and installation. (In Eastern Canada, distributed by Creswell-Pomeroy, Ltd., Montreal.)*

Ingersoll KOOLSHADE* SUN SCREEN

"It's Cooler in the Shade!"

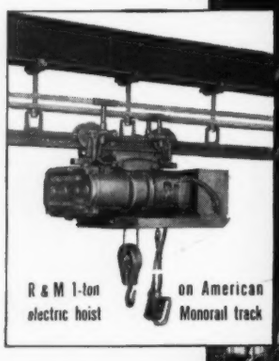
* Trade Mark . . . Property of Ingersoll Steel & Disc Division, Borg-Warner Corporation

Ingersoll Steel & Disc Division
Borg-Warner Corporation, Dept. O-6
310 So. Michigan Ave., Chicago, Illinois.

Please send your SUN HEAT DEMONSTRATION KIT (without charge) and also complete KOOLSHADE Sun Screen literature.

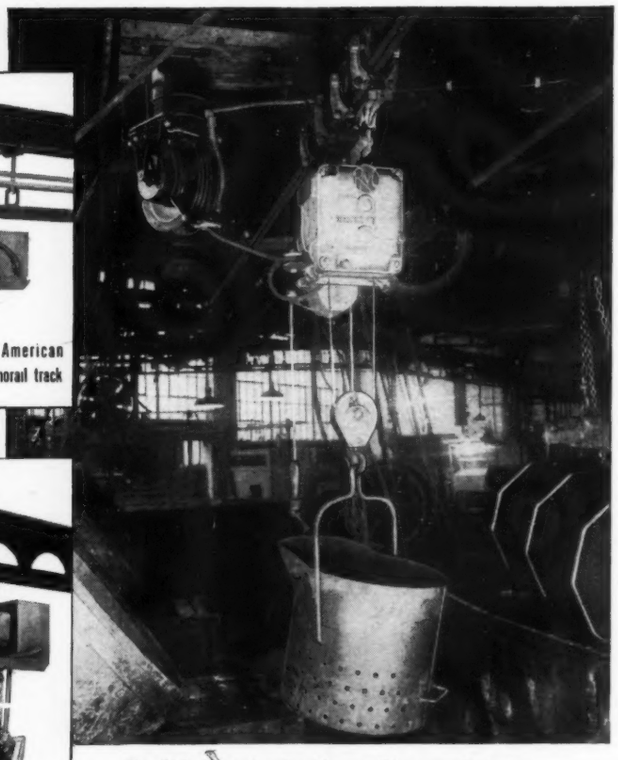
Name .....
Firm .....
Address .....
City ..... State .....

Up goes Production WITH R & M MONORAIL HOIST



R & M 1-ton electric hoist on American Monorail track

R & M 1-ton electric hoist on Cleveland Tramrail track



R & M hoist on Louden Monorail in manufacturing plant producing stampings and small castings

WHEN the powerful hook of an R & M Monorail hoist gets down to business, *up* goes production! This remarkably compact hoist produces maximum lift in a minimum of headroom space. Symmetrical design provides precise balance and load suspension at all times . . . the position of drum in frame allows lifting from anywhere within hook reach without cable-winding interference.

Fits Any Type of Monorail

R & M hoists are designed to fit any make of monorail now installed in your plant. Let an R & M hoist expert study your setup and show you how quickly you can speed material handling without altering your present layout.

The R & M Monorail is one of 2,000 standard types of R & M hoists and cranes ranging from ¼-ton bantams to 10-ton huskies . . . built from the ground up in one plant . . . famed in every industry for service reliability.

Contact your nearest R & M sales and service office listed below or write the factory for time- and money-saving hoist and crane details. It will pay you to "take it up" with R & M.

Albany . . . . . 364 Broadway	Cleveland . . 352 Rockefeller Bldg.	Newark . . . . . 700 Bergen St.
Atlanta . . . . . 909 Myrtle St.	Denver . . . . . 1424 16th St.	Philadelphia . . . 401 N. Broad St.
Boston . . . . . 55 Long Wharf	Detroit . . . . 2921 E. Grand Blvd.	Pittsburgh . . . . . 705 Oliver Bldg.
Buffalo . . . . . 2005 Delaware Ave.	Houston . . 4715 Harrisburg Blvd.	San Francisco . . . 237 Rialto Blvd.
Chicago . . . . 2400 W. Madison St.	Jacksonville . . . . 305 Bisbee Bldg.	Seattle . . . . . 216-17 Walker Bldg.
Cincinnati . . . . . 418 New St.	New York . . . . . 200 Varick St.	Syracuse . . . . . 304 Tower Bldg.

Montreal . . . . Lyman Tube & Supply Co., Ltd.

ROBBINS & MYERS, Inc.

HOIST & CRANE DIVISION • SPRINGFIELD, OHIO

MOTORS • FANS • MOYNO PUMPS • FOUNDED 1878

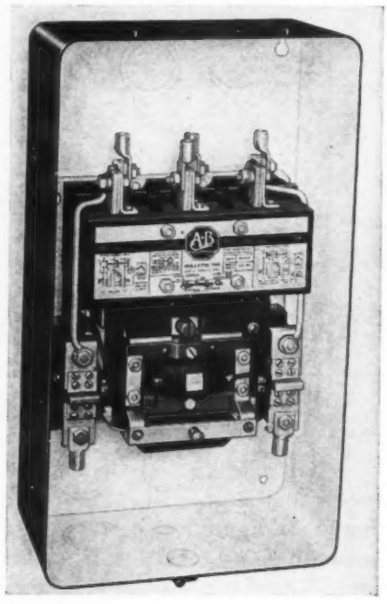
in any direction. Projects a blast of cooling air in a concentrated stream to remote spaces without ducts. DeBothezat Ventilating Equipment Division, East Moline, Ill.

Fans

Features claimed for 12- and 16-in. 3-speed oscillating fans include aluminum blades, quietness of operation, lower current consumption, and improved operating characteristics. The 12-in. oscillating fan on adjustable floor stand is equipped with quiet type overlapping blades. Has a capacitor motor and operates at slow speed. Floor stand is adjustable from 3 ft. 3 in. to 4 ft. 9 in. Three-speed sliding switch in stand base. Emerson Electric Mfg. Co., St. Louis, Mo.

Solenoid Starter

Size 4, Bulletin 709 solenoid starter has a maximum horsepower rating of 50 hp., 220 volts, and 100 hp., 440–550–600 volts. Greatly reduced in size, a generous



amount of wiring space is still provided. Starter can be provided with or without inclosures for all kinds of applications, both hazardous and non-hazardous. Allen-Bradley Co., 1311 S. First St., Milwaukee

Protective Cream

The protective hand cream known as Mitts is used before starting work, and is claimed to protect the hands from grease, paint, oils and other matters difficult to clean, and to prevent occupational skin diseases. Is soluble in water, washes off easily with soap taking dirt with it. Mitts, 367 45th Street, Brooklyn

Magnetic Separator

For batch or continuous operation at capacities of from 100- to 250-lb. per hour. Has deep, powerful, intense magnetic field for extracting reluctant minute iron particles from powdered vitreous enamel. Type KB separator has an electric vibrating type feeder for even distribution,

INDUSTRY'S CHOICE!

FOR DRIP AND DRAIN LINES

CRANE No. 212-P
PLUG TYPE GLOBE VALVES
(up to 250 pounds, Steam)

For dependable flow control in every service look to the great Crane line of 38,000 valves and fittings. There's a well-stocked Crane Branch or Wholesaler serving every industrial district.

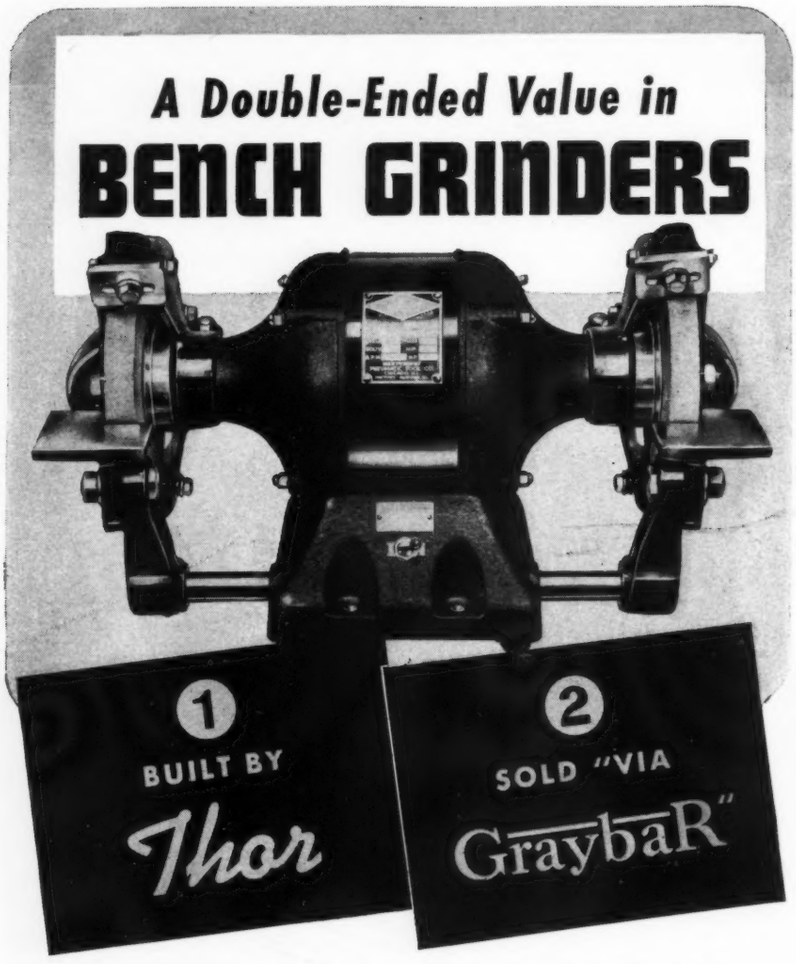
Extra wide seating surface resists wire drawing and erosive effects of foreign matter. Tapered disc of Nickel Alloy permits fine, accurate flow regulation. Seat ring is renewable; of Exelloy, specially hardened to withstand hard wear and temperatures. Body is heavy brass; easily dismantled and re-assembled.

CRANE

VALVES • FITTINGS
PIPE • PLUMBING
HEATING • PUMPS

CRANE CO., GENERAL OFFICES: 836 SOUTH MICHIGAN AVENUE, CHICAGO

A Double-Ended Value in
BENCH GRINDERS



These new bench grinders are built for all-round service in grinding, buffing and wire wheel work. Powered by completely enclosed motors, they are cool, quiet running and free from vibration. Oversize and dust-tight ball bearings require greasing attention only about once a year. Grinders are available in wheel size diameters of 6" and 7"; ½", ¾" and 1" widths in regular and heavy duty types . . . all are provided with adjustable tool rests and extra heavy wheel guards with chute.

When you go to GRAYBAR for these grinders or other portable electric tools, you get an extra measure of satisfaction insurance. » » » GRAYBAR'S knowledge of the performance standards for electrical equipment is reflected in the motors with which these tools are powered. GRAYBAR'S experience helps assure you the right motor to meet individual service conditions. A single call to GRAYBAR brings you all the cable, wiring devices or other accessories you need for installation of dependable power circuits to the equipment.

In addition to bench grinders, GRAYBAR also offers such *Thor* portable electric tools as hammers, drills, polishers, nut setters, sanders, saws, screw drivers. Whatever your needs, you'll appreciate the prompt cooperative service you get from GRAYBAR. Write for Catalog No. 35-B, which gives the complete story on the new *Thor* Grinder or other electrically powered tools.

Executive Offices:
Graybar Bldg., New York, N.Y.
GraybaR
IN OVER 80 PRINCIPAL CITIES

GraybaR QUALITY
Distributed by
GraybaR
ELECTRIC COMPANY

provides protection against contamination of finished product, is equipped with automatic trap gate for fine iron collected outside the flow. Stearns Magnetic Mfg. Co., Milwaukee

Blue Glass for Aluminum and Brass Welding

Compounded to filter out injurious rays of light in conditions of excessive glare, Alubro-Weld, a blue glass, is suitable for aluminum and bronze welding, glass work, instrument making, and other operations where a sodium yellow glare is encountered. Has high visible light transmission but blocks out harmful ultra-violet rays and reduces infra-red ray transmission. Willson Products, Inc., Reading, Pa.

Cranes

For economical installation where service is not extreme, features of Types S.A. and L.S.A. cranes include one-piece all-steel welded trolley frame construction; horizontally split hoist gear housing; heat-treated, rolled steel, machine cut hoist gearing; splash lubricated hoist gearing and bearings; removable mechanical load brake; standard foot mounted ball-bearing motors; wide flange triple girder bridge construction; controls for either cab or floor operation. Northern Engineering Works, Detroit.

Raintight Service Equipment

Inclosures have substantial watertight tops with lap joints which exclude moisture. Overlapping flanges guard against driving rain or jets of water. Cover can

be held in open position. Knockouts are located below lowest live parts. Drip hole in bottom prevents accumulation of moisture. Made of code gage galvanized steel with aluminum finish, with or without conduit hubs. Deadfront shields prevent accidental contact with live parts and are sealable. Line includes 60-amp. main and range switches with 0, 2, or 4 plug fusible lighting circuits. Parallel or multiple bussing of main and range fuse-breaks is available; line side is equipped with 100-amp. solderless connectors and 60-amp. on load side. Square D Company, Detroit

Motors

Protected motor of the open type, providing protection against dripping liquids, metal chips, or falling particles. Can be

IN DEFENSE OF BEARINGS USE LINCOLN LUBRICATING EQUIPMENT

1-Filler-Type Grease Guns

2-KLEENSEAL and Button Head Grease Fittings

3-Filler Pump with Gun Carrier

LUBRICATION is the first line of defense against needless wear and tear on industrial machinery. Now more than ever before dependable equipment is required to dispense grease to bearings, and Lincoln Lubricating Equipment does the job efficiently and safely.

The Lincoln line of industrial equipment includes many types of hand operated, electric and air operated grease guns, automatic and manually controlled centralized systems, and a full range of all types and sizes of grease fittings—all the equipment necessary for dispensing grease from the original container to the bearing without the usual danger of contamination.

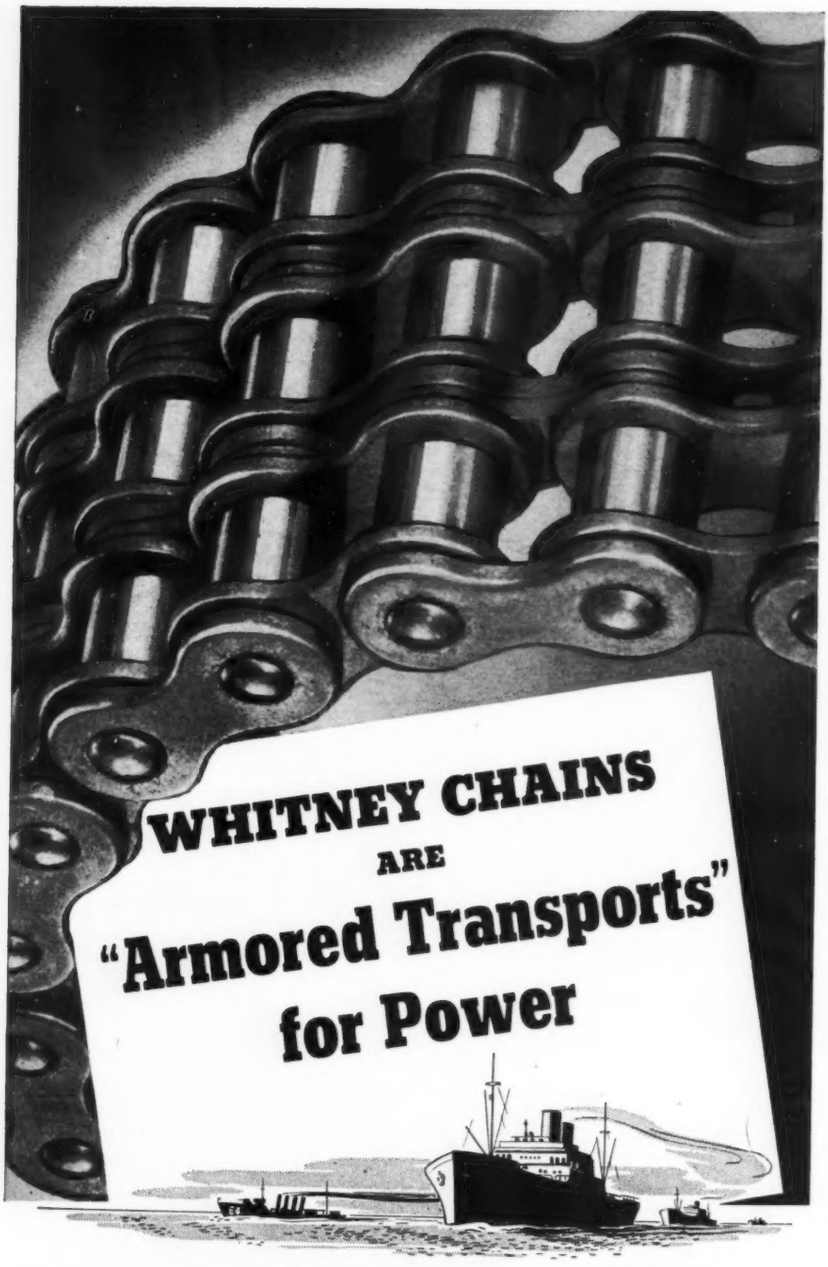
Call your local mill supply distributor or write us for Bulletin No. 100X, plus complete information on Lincoln systems for safe lubrication.

1ST LINCOLN LEADS in quality and value

LINCOLN ENGINEERING COMPANY

Pioneer Builders of Engineered Lubricating Equipment

ST. LOUIS, MO., U. S. A.



Whitney Chains carry the full force of power straight through to the production front... and put it into action without losses on the way. This positive power transmission means top rate of production, constant-speed operation, uniform product-quality . . . all at the lowest cost per drive unit, assured by Whitney's alloy-armored steels that fight off the attacks of wear far longer. Tell your engineers to check into the matter ... and see what Whitney Chains can save on each one of your drives.

The Whitney Chain & Mfg. Co., Hartford, Conn.

WHITNEY CHAINS

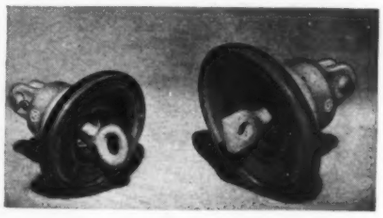
WHITNEY PRODUCTS

Roller Chain & Sprockets, Silent Chain & Sprockets, Conveyor Chain & Sprockets, Roller Chain Flexible Couplings, Automatic Load Limiting Sprockets, Automatic Drive Tensioners, Woodruff Type Machine Keys and Cutters.

furnished with either ball or sleeve bearings. Terminal box is cast iron, water and dust-tight, accessible for wiring, adjustable to 4 positions. Standard NEMA dimensions are maintained, interchangeable with other open type motors which adhere to NEMA dimensions. Howell Electric Motors Co., Howell, Mich.

Suspension Insulators

Designed to reduce mechanical breakage small-diameter suspension insulators



are made with a smooth under surface and heavy porcelain sections. Sizes include 6-in. 10,000-lb. unit with clevis cap and eye pin, 7½-in. 15,000 lb. units with socket cap and ball pin, and 7½-in., 15,000-lb. units with clevis cap and clevis pin. Ohio Brass Co., Mansfield, Ohio.

Gage Dials

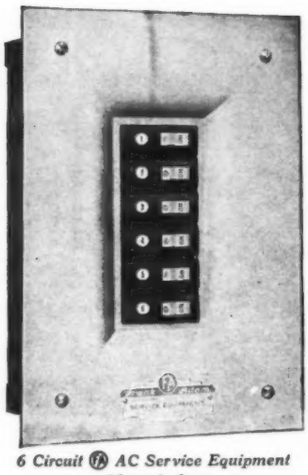
Makers of plastic gage dials claim that they not only save aluminum for defense purposes but also that they will not warp, corrode, rust, crack, and can be washed. Dial graduations are permanently sealed between layers of clear plastic. Face is white, without gloss, markings are jet black. Ashcroft Gauge Division of Manning, Maxwell & Moore, Inc., Bridgeport, Conn.

Filament Lamps for Vibration Service

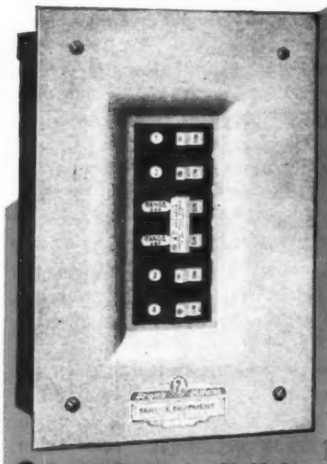
An electric light bulb whose construction protects the filament from vibration and jar. Designed for industrial and commercial use where high frequency vibration set up by motors in constant use tends to weaken bulb filament. Filament is cushioned against shock by 4 molybdenum pigtail springs welded to 6 flexible filament supports. Available in 100, 150, and 200 watt sizes in 5 low voltages from 110 to 130 volts, and in 4 high voltages from 220 to 250 volts. Either inside frosted or clear. It is claimed that the average burning life is 1,000 hours. Wabash Appliance Corp., Brooklyn.

Bronze Bearings

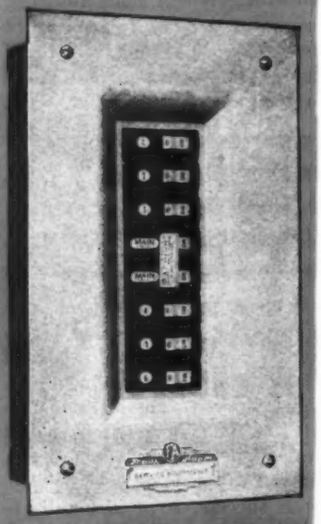
Selflube porous bearing in additional shapes and sizes. Made from powdered alloys, molded to size in desired shape, baked, and quenched in oil. Average porosity of 35 percent enables these bearings to store large amount of oil which forms a protective oil film on bearing surface. Tensile strength of over 35,000 lb. per square inch. Keystone Carbon Co., 1935 State St., Saint Marys, Pa.



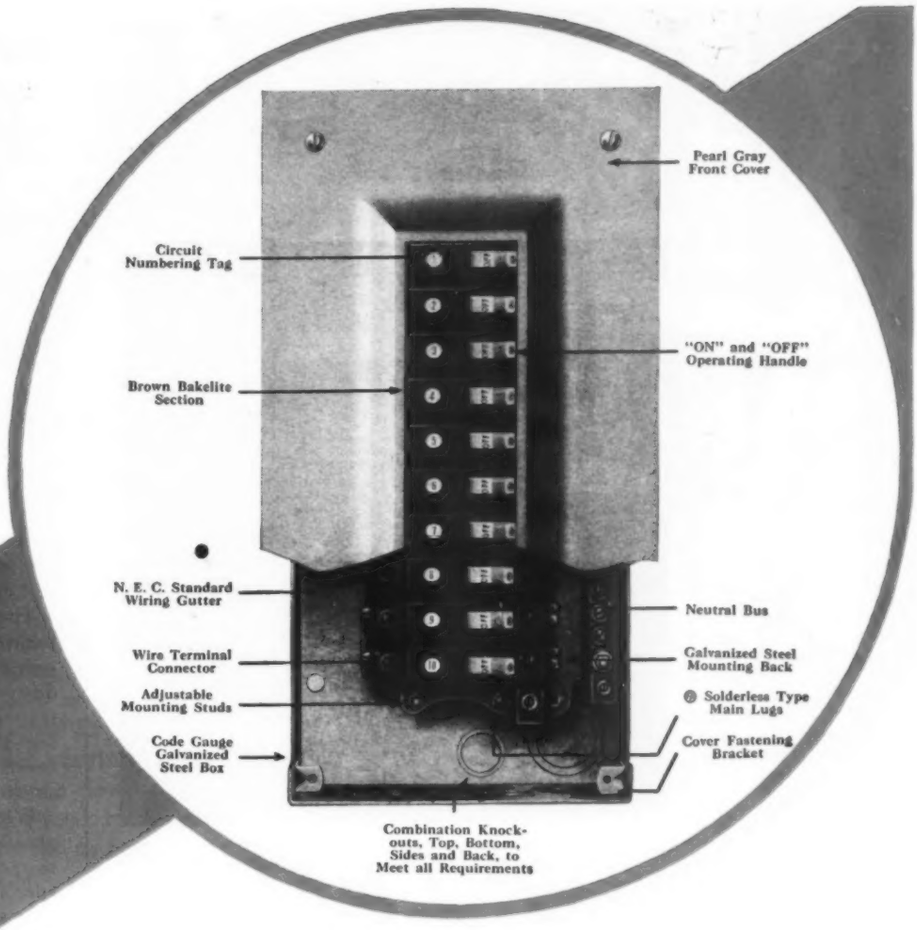
6 Circuit Ⓕ AC Service Equipment with main lugs.
Cat. No. SE60-3L7F
List Price $11.00



Ⓕ Service Equipment with 35 Amp. D. P. Ⓕ AC Circuit Breaker for range circuit. Also 4 S. P. branch circuits.
Cat. No. SE41-3L7F
List Price $11.00



Ⓕ Service Equipment with 50 Amp. D. P. Ⓕ AC Circuit Breaker Main and 6 S. P., AC Circuit Breakers.
Cat. No. LC60-3B5F
List Price $13.00


Pearl Gray Front Cover
Circuit Numbering Tag
"ON" and "OFF" Operating Handle
Brown Bakelite Section
N. E. C. Standard Wiring Gutter
Neutral Bus
Wire Terminal Connector
Galvanized Steel Mounting Back
Adjustable Mounting Studs
Ⓕ Solderless Type Main Lugs
Code Gauge Galvanized Steel Box
Cover Fastening Bracket
Combination Knock-outs, Top, Bottom, Sides and Back, to Meet all Requirements

You pay no premium

when you specify

Ⓕ Type AC Circuit Breaker Service Equipment and Load Centers

—but this is what you get:

- Modern protection against overload.
- Only two handle positions — ON and OFF—no intermediate position. Breakers reset automatically.
- Interchangeable as to capacities.
- One-piece galvanized box — provides perfect ground connection.
- Bonderited (rustproof) cover, with pearl gray lacquer finish.
- Solderless lugs of improved type.
- Ample knockouts.
- Plenty of wiring space.

For 120 volt AC Service . . . Capacities: 15, 20, 25, 35, and 50 amperes . . . Approved by Underwriters' Laboratories.

There is a Wholesaler near you

who carries Ⓕ Service Equipment in stock, for quick delivery. Write us for his name and address—and for Bulletin 62 . . . Frank Adam Electric Company, St. Louis, Mo.

EST. 1891 THE SIGN OF A BETTER JOB
Frank Ⓕ Adam
1891 FIFTY YEARS SERVICE 1941
FRANK ADAM ELECTRIC CO. ST. LOUIS, MO. U.S.A.

When you handle your loads with a Zip-Lift, there is no chain to interfere because this is a real wire rope hoist. There's no tangle, no dangle, no jangle.

Its price is low — yet here are the quality features you find only in the more expensive equipment. It uses preformed, non-spinning cable; it's full electric, with push-button control—with crane type limit switch and two brakes for maximum safety. All mechanical parts are 5 times stronger than rated capacity. Operates on any standard electric circuit. Prices start at only $140, completely equipped, ready to install. Available with interchangeable mountings for bolt, hook, or trolley suspension. Write for bulletin H-20.

4525 West National Avenue, Milwaukee, Wisconsin

HARNISCHFEGER
CORPORATION
HOISTS • WELDING ELECTRODES • MOTORS P&H EXCAVATORS • ELECTRIC CRANES • ARC WELDERS

Why Not T. B. Tests for All?

(*Continued from page 55*)

the company physician for advice and treatment, and, in accordance with the law, they were also reported to the Cleveland Department of Health.

A few cases of heart trouble also were discovered and reported to the company physician for treatment.

The management was gratified at the response of the employees in this safety and health program, and pleased to know how few were affected. Immediately following the first tests, employee representatives began to solicit the 900 who had stayed out of the line-up. The question of making the test compulsory for all employees is still open.

The cost of hospitalizing tubercular patients in Cuyahoga County alone is over $1,000,000 a year; and the large industries, which are among the biggest taxpayers, are interested in encouraging preventive measures, and in discovering cases of incipient tuberculosis as early as possible.

With many vital industries, hiring greatly increased numbers of workers to speed up the defense program; with special training programs taking in men who cost money to train and more to replace, if they become ill later when their work is needed badly; and with the possibility of damage suits from workers who contract the disease, or claim to do so, from fellow workers—the comparatively simple and inexpensive testing of old and new employees for tuberculosis and heart ailments, by fluoroscope and X-ray, might well be considered as an economical means of guarding the safety and health of all industrial employees.

Defense—Its Impact on Morale

(*Continued from page 65*)

000 horsepower monthly (and this figure is expected to be doubled within the current year) it is being produced by some 15,000 employees working in a plant that covers a total production space of 1,600,000 square feet. And more production space is contemplated.

It is human nature to want to be associated with success, so it is logical to believe that this record has had much to do with the cross-section of American manpower which clamors for and is sometimes successful in gaining Aircraft employment.

For instance, there is a crew at Aircraft known facetiously as "The Rover

Four Reasons Why It Pays to Select

New, Improved CENTURY *Job Selected* Explosion Proof Motors

For Hazardous Surroundings

For atmospheres containing explosive mixtures of gasoline, petroleum, naphtha, alcohols, acetone, lacquer solvent vapors or natural gas, call for Century *Job Selected* Explosion Proof Motors. Designed to meet varying degrees of explosion hazards, these new and improved Century Explosion Proof Motors carry Underwriters' Laboratories approval for Class I, Group D, hazards.

Here are four important reasons why it will pay you to install Century Explosion Proof Motors in your plant or on your product:

1 To Protect Life

2 To Protect Property

3 To Reduce Insurance Costs

4 To Assure Continuous Production

Century Explosion Proof Motors will not start a fire or explosion in Class I, Group D, atmospheres because they are so constructed that a flame developing inside the motor is prevented from getting outside, and interior explosions cannot develop sufficient pressure to crack the motor enclosure.

All of the various types of SC motors are to be had in explosion proof construction, such as high torque, low torque, normal torque, multiple speed, vertical, etc.

Century Explosion Proof Motors are only one example of the wide range of Century Job Selected Motors specifically designed to meet the demands of particular jobs and the surrounding conditions. Available in a variety of types and sizes, from fractional to 600 horsepower.

For full information on all the advantages of new, improved Century Explosion Proof Motors, as well as on the complete Century line, call in your nearest Century Motor Specialist today.

CENTURY ELECTRIC COMPANY

1806 Pine St. St. Louis, Missouri

Offices and Stock Points in Principal Cities

Century MOTORS

One of the Largest Exclusive Motor and Generator Manufacturers in the World

MAINTAIN PLANT EFFICIENCY WITH

VALVES HYDRANTS *and* PIPE LINE ACCESSORIES

M & H products are well known for high quality material and expert workmanship. They have been used in industrial plants for many years. The M & H line also includes B & S Cast Iron Fittings, Flanged Fittings, Flange and Flare Fittings, Valve Boxes, Shear Gates, Wall Castings, Cutting-in Tees and similar accessories.

M & H Valves are used in industrial plants for water, gas, steam, oil, chemicals and are furnished in all commercial sizes from 2" to 30", inclusive. They are cast iron body, bronze mounted, furnished double disc parallel seat or solid wedge. They are heavily proportioned and have a high factor of safety.

M & H PRODUCTS INCLUDE

FIRE HYDRANTS	SHEAR GATES
GATE VALVES	MUD VALVES
TAPPING VALVES	VALVE BOXES
WALL CASTINGS	FLAP VALVES
SPECIAL CASTINGS	SLUDGE SHOES
TAPPING SLEEVES	FLANGE AND FLARE FITTINGS
CHECK VALVES	FLANGED FITTINGS
FLOOR STANDS	B & S FITTINGS
EXTENSION STEMS	CUTTING-IN TEES

M & H VALVE AND FITTINGS COMPANY

ANNISTON, ALABAMA

Boys." They unload cylinder barrels, assemble machinery, move parts, and in general act as shock troops in the Aircraft army. There is no better laboratory in which to dissect the heterogeneous groups of men who come to East Hartford, most of them for something more than just jobs.

On this crew at different times there have been a former circus strong man, a one-time stock broker, the former president of a bonded warehouse, boys as well as men from the farms, mechanics and craftsmen from other industrial plants, youngsters just out of high school, and white-collar men with families to support and the expectant look of a new future in their eyes.

Defense needs opened up new opportunities for these men, a chance for a career as well as economic rehabilitation. They entered into their work routine and tackled their job demands much as they would have conducted themselves after matriculation in an engineering school.

Educational Opportunities

Pratt & Whitney Aircraft has become an institution in the sense that with its work requirements there are also courses of instruction and social and recreational activities in many ways comparable to those of a college.

There are four general plans for employee advancement through Aircraft sponsored studies;

1. Long-term training of high-school graduates to make them highly skilled technicians and supervisors.

2. Grooming college men for junior executive positions through practical work in the factory and supplementary engineering studies.

3. Adapting learners—men with limited training—to the special requirements of airplane engine building.

4. Special training of employees—girls as well as men—to enable them to become more capable producers.

Engineering studies are also available through extension courses at the University of Connecticut School of Engineering.

Of the strictly employee organizations, the Pratt & Whitney credit union is one of the largest in the country; its assets amount to $657,831. Since it was started loans amounting to $2,087,824 have been made, as of the end of 1940. Five separate flying clubs have been formed, the credit union financing the planes and the individual members paying for instruction and sharing the ship. Basket ball, baseball, softball, soccer, golf, tennis, swimming, wrestling, athletic teams of every kind except football, give the men physical

"SINCE INSTALLING HEAT KILLERS.. WE MAINTAIN REGULAR PRODUCTION THRU SUMMER MONTHS"

ANOTHER COPPUS BLUE RIBBON PRODUCT

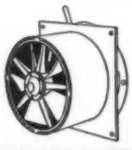
"We have had a number of these Heat Killers installed in our Forge Shop for some time and are very well pleased with them," writes a large automobile manufacturer. "Since installing, we have been able to maintain our regular production thru summer months, as well as the winter. The men in the shop like them also."

When you see a product with the identifying Blue Ribbon, you know it is one of the Coppus Products which are "Designed for your Industry—Engineered for You." It was made specifically for the use to which you put it, and if necessary built specially for *your* plant. Precision work and careful inspection guarantee Coppus high quality.

Coppus Engineering Corporation, 206 Park Avenue, Worcester, Mass. Sales Offices in THOMAS' REGISTER; other "Blue Ribbon" products in SWEET'S Catalog.

COPPUS BLUE RIBBON PRODUCTS

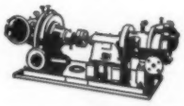
Designed for your Industry
Engineered for You



COPPUS-DENNIS FANMIX GAS BURNER. New method of mixing gas and air insures perfect gas-air ratio—instant, complete combustion. Bulletin 410-2.

COPPUS AIR FILTERS. For engines and air compressors. Perfect, uninterrupted filtration. Bulletin F-310-4.

COPPUS CABLE MANHOLE AND TANK VENTILATORS. For any confined working space. Special adaptions for boilers, tank cars, shipholds. Bulletin 163-1.



COPPUS STEAM TURBINES. For small H.P jobs — six sizes (and prices) from 150 H.P down to fractional. Steam—Gas—or compressed air driven. Bulletin 135-9.

ADVANTAGES OF COPPUS HEAT KILLERS

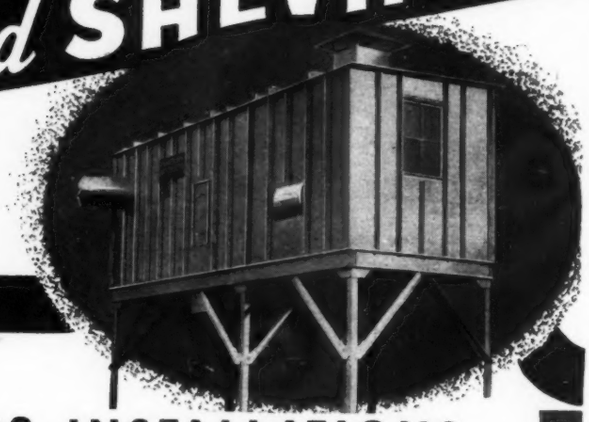
By directing cooling air right on the men and the job — by preventing the recirculation of stale air — Coppus Heat Killers restore energy to men working at high temperatures. (Human efficiency at 110° F averages 10% of normal.)

Various sizes and models, all portable, delivering from 1500 c.f.m. at high velocity (Vano model) to 15,600 c.f.m., at moderate velocity (Aeroplane model).

Write today for Bulletin 160-4, which tells you how you can keep up efficiency.

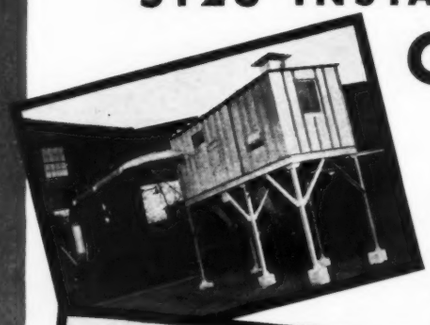
COPPUS

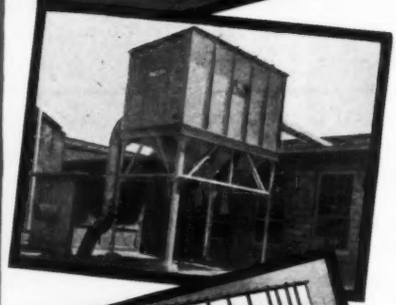
CO-OPERATING with SAFETY and SALVAGE

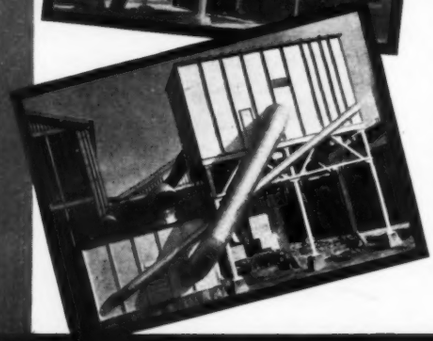


5128 INSTALLATIONS

CONTROL DUST







★ SAFETY from the destructiveness of dust means protection to your equipment, your materials, your finished product and to your employees. Without adequate DUST CONTROL the "dust hog" runs all over your plant—eats savagely into your profits.

★ SALVAGE, in the dust control sense, means collecting valuable by-products (now lost in process of manufacture in form of dust) and collecting this material for re-use or re-sale.

★ PANGBORN has co-operated with industry continuously for 31 years—providing economical SAFETY and SALVAGE in Dust Control. May we co-operate with you, too? Write

PANGBORN

WORLD'S LARGEST MANUFACTURER OF DUST COLLECTING AND BLAST CLEANING EQUIPMENT

PANGBORN CORPORATION · HAGERSTOWN, MD.

outlet for their energies in league and tournament games. State and national championships have been won by company teams. An 11-piece orchestra and a 72-man choral group frequently broadcast over one of the local radio stations. Local sport groups get together to attend World Series games, a Joe Louis fight, or other sports events. Others go to Hartford or neighboring cities for concerts and plays. The *Aircraft Journal*, a monthly tabloid, is run entirely by employees, with full-time paid editor; its third edition, published March 20, cost only $46 over its advertising receipts for its free circulation of 25,000.

It is true, of course, that other industrial organizations throughout the country have similar employee-sponsored group activities. However, it must be borne in mind that Pratt & Whitney Aircraft has grown to its present magnitude within a short period of time; its plant facilities have been quadrupled within a period of two years, and its personnel has expanded to its present numbers, mostly within the last year or so. It stands to reason, therefore, that these activities have been largely supported by the newer employees.

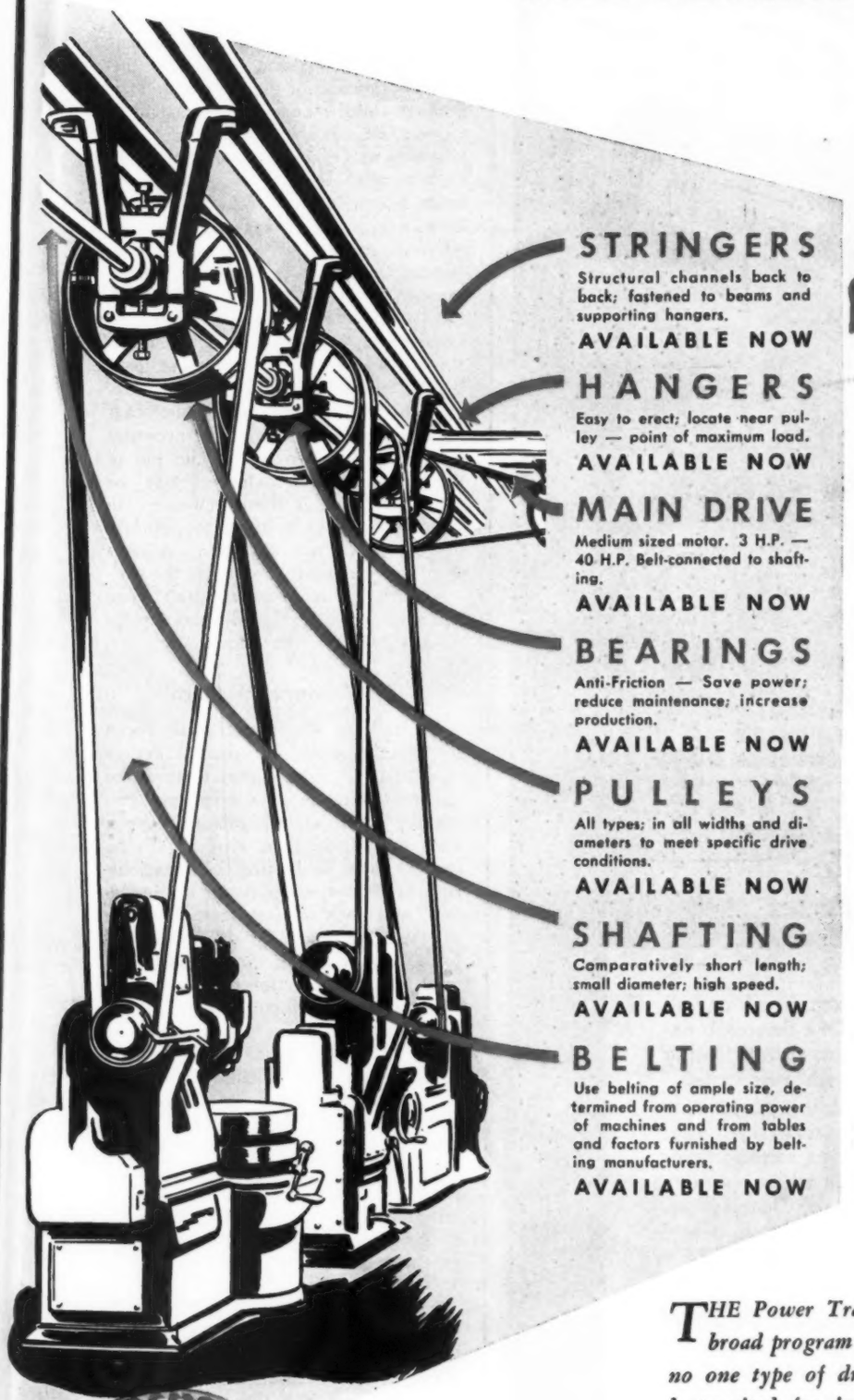
Some "Beefing," of Course

Of course there is some grumbling or "beefing" in Aircraft plants. It would be unhealthy if there weren't. As a writer in *Collier's* recently said, an army wouldn't be an army without grumbling and beefing—it takes up the slack, smooths rough-edged tempers, lets sparks fly that otherwise might be left to smolder to a blaze; and it often has its humorous twist since almost invariably it will show up the man himself as being responsible for his own complaints.

To the new employees, the five- and ten-year men receive much the same respect as "Old Boys" receive in a preparatory school or seniors or student council members receive in a college. On the streets, either outside the plant or in neighboring towns where the majority of the men live, the blue and white employment badge is as effective a means of an introduction as an Elk's tooth or a Masonic pin, because all wearers are joined to serve a common cause. On March 16, when the factory was opened to the families of employees, more than 20,000 were clocked through the gates. As the men piloted their wives, sweethearts, parents, and children through the aisles, passing parts and engines in various stages of processing or finishing, the accurate technical explanations of the work by men who were not required to know more than their individual jobs, would have surprised Aircraft engineers.

Here is an industrial plant, where

MMEDIATE *Speed-up* OF PRODUCTION
WITH MECHANICAL DRIVE EQUIPMENT



STRINGERS
Structural channels back to back; fastened to beams and supporting hangers.
AVAILABLE NOW

HANGERS
Easy to erect; locate near pulley — point of maximum load.
AVAILABLE NOW

MAIN DRIVE
Medium sized motor. 3 H.P. — 40 H.P. Belt-connected to shafting.
AVAILABLE NOW

BEARINGS
Anti-Friction — Save power; reduce maintenance; increase production.
AVAILABLE NOW

PULLEYS
All types; in all widths and diameters to meet specific drive conditions.
AVAILABLE NOW

SHAFTING
Comparatively short length; small diameter; high speed.
AVAILABLE NOW

BELTING
Use belting of ample size, determined from operating power of machines and from tables and factors furnished by belting manufacturers.
AVAILABLE NOW

AVAILABLE *NOW*

THE whole future of civilization depends upon putting every available machine in America to work NOW. Idle machines are costing lives today.

Many machines are out of production waiting for special drives. These machines can be cut in on the production line NOW . . . AT ONCE . . . by drawing from the available stocks of manufacturers and distributors, the simple mechanical equipment needed for efficient, modern group drives.

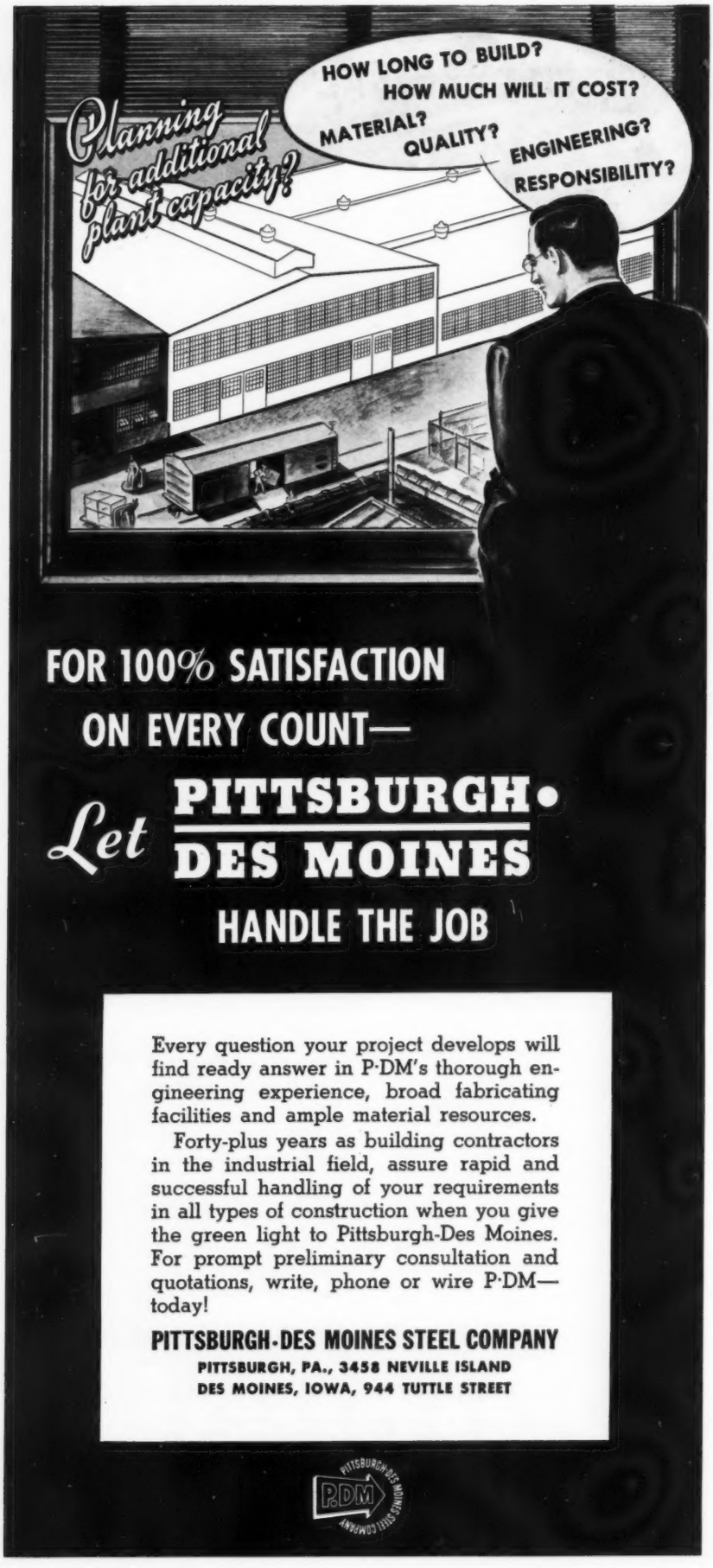
Modern group drives...AVAILABLE NOW . . . are adaptable to all types of machinery . . . they increase production through more uniform machine speeds . . . they can be installed at low initial expense . . . they cost little to maintain, are quickly and easily installed and are durable, efficient and reliable.

Actual case studies have proved that the saving in connected horsepower averages 26%; installation costs are reduced 41% and power factor increased 15%.

THE Power Transmission Council is concerned solely with a broad program of Planned Power Transmission. It recommends no one type of drive, but fosters the selection of power drives best suited for individual operating conditions and the proper combination of individual and group drives which transmit power from source to driven machines most effectively and economically.

POWER TRANSMISSION COUNCIL, INC. PTC

POWER TRANSMISSION COUNCIL, INC.
53-63 PARK ROW NEW YORK, N. Y.



FOR 100% SATISFACTION
ON EVERY COUNT—

Let PITTSBURGH-DES MOINES HANDLE THE JOB

Every question your project develops will find ready answer in P·DM's thorough engineering experience, broad fabricating facilities and ample material resources.

Forty-plus years as building contractors in the industrial field, assure rapid and successful handling of your requirements in all types of construction when you give the green light to Pittsburgh-Des Moines. For prompt preliminary consultation and quotations, write, phone or wire P·DM—today!

PITTSBURGH-DES MOINES STEEL COMPANY
PITTSBURGH, PA., 3458 NEVILLE ISLAND
DES MOINES, IOWA, 944 TUTTLE STREET

PDM PITTSBURGH-DES MOINES STEEL COMPANY

the attitude is not that of "every man for himself and the devil take the hindmost"; neither is there the attitude of "t'hell with the management—kick in, we're doing the labor, we're producing your engines." Even the newer men, those who have come from other industrial plants in different sections of the country where labor has been more of a problem-child, soon catch the spirit of cooperation. It is not a lack of racial mixtures which keeps peace in the Aircraft family, because there seem to be as many Polish, Greek, Hungarian, Irish workers, and various American mixtures, as there are of what we have come to think of as men of pure Yankee stock.

These new men are assimilated so rapidly that it is difficult to differentiate the new from the old without looking at badge numbers. To be sure, there is a "freshman" period, but that quickly passes because of the necessity for getting "broken in" on the job so that the production tempo may be maintained. It is these new men, in fact, who are in a hurry to get into the many Aircraft activities. A new-employee waiting list exists for the various clubs because there isn't time enough to get them signed up as rapidly as they register their intent.

No Extreme Pressure

Contrary to what is generally taken for granted under our present degree of industrial mobilization, there is no apparent extreme of defense pressure bearing down on Aircraft employees. They take it in their stride. Yet no one of them is lacking in consciousness of the responsibility of his individual job; each is every moment aware of the vital need for his individual job's perfection whether it be heat-treat, service inspection, final assembly, or even the unpacking of parts in the receiving room. There is little or no tense rush prompting shortcuts and carelessness; there is little or no irrational cracking down by foremen to step up output; there are few or no contradictory orders from upstairs to confuse supervisors and upset departmental routine. It should be borne in mind, however, that these statements must be qualified by the old adage "the exception proves the rule." This is no industrial Utopia.

Yet an amazing quiet and leisureliness do exist inside the plant. When the assembly line was moved into new Plant F last February, there was so little confusion that the great majority of employees did not know the move was being made. A thousand men, many of them volunteers after their regular hours, were recruited for the task of putting 400,000 square feet of empty working space into straight-line

Where slips DO count...

...PLAY SAFE WITH THIS MODERN INDUSTRIAL FLOORING!

ACCIDENTS caused by slippery floors needn't loom large among your compensation claims, needn't mean expensive production delays, either . . . not if your floors are non-slip Armstrong's Industrial Asphalt Tile! Trucks can move faster and safer too, without skidding on grades and corners, because this smooth-surfaced factory flooring provides ample traction.

Armstrong's Industrial Asphalt Tile, a product of a *flooring manufacturer*, was developed *specifically* for industrial service. That's why it offers you a balanced combination of flooring features not to be found in any other material! Look at all these decided advantages. Check your present floor against this list.

- Low First Cost
- Fast Installation
- Ready to Use As Soon As Laid
- Low Maintenance Cost
- High Tensile Strength
- Resistant to Denting
- Self-Healing
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- Nonspalling
- Nonsparking
- Not Damp
- Fast Trucking
- Light Weight
- Verminproof

Get the whole story about Armstrong's Industrial Asphalt Tile. Fill out the coupon below and mail it to Armstrong Cork Company, Resilient Tile Floors Department, 1242 State St., Lancaster, Pennsylvania.

ARMSTRONG'S FLOORS
INDUSTRIAL ASPHALT TILE

Armstrong Cork Company
Resilient Tile Floors Department
1242 State Street, Lancaster, Pa.
Gentlemen:
Please send me the new booklet, "Facts You Should Know About Industrial Flooring."

Name.....

Firm.....

Address.....

City and State.....

What makes KATHABAR AIR CONDITIONING Different?

The Answer—Kathabar's principle of *accurate humidity control* combined with conventional air-conditioning methods provides flexibility of application to produce desired results.

● In the ultra-modern plant of The Gelatin Products Company it was necessary to provide air conditioning for comfort and also special atmospheres for manufacturing and filling of tiny gelatin capsules by automatic equipment and their storage — three separate, different applications. ● Kathabar solves this triple-threat problem through its ability to give the desired atmosphere for each specific application. Today and every day scheduled production continues regardless of variable outside weather conditions.

KATHABAR

1 2 3

1. Outside air comes in contact with the Kathene liquid by means of a Kathabar "Contactor."

Humidification or de-humidification is in direct proportion to the temperature of the Kathene . . . a temperature which is automatically controlled to add to or absorb the humidity as desired. This method of control is extremely accurate and very simple in operation.

2. The humidity-conditioned air passes from the Kathabar Contactor to heating or cooling elements for *temperature conditioning*.

3. The completely conditioned air enters the comfort area or processing application as the *perfect atmosphere*.

Investigate Kathabar! Write for descriptive data today.

"TAILOR MADE" for the difficult jobs of AIR CONDITIONING

KATHABAR

A PRODUCT OF SURFACE COMBUSTION CORPORATION

TOLEDO, OHIO

production. The job was completed in 52 hours and 10 minutes, and a new production high was established two days later.

There is a reason for this spirit of "cooperation plus," and that reason is not all attributable to management.

Certainly management plans and creates and causes things to be done. But it definitely cannot plan, create, or cause employee psychology. And this is definitely a unique employee psychology; it is almost tangible. The employees have created it of themselves —or perhaps it just grew. It would seem, from association with the men at their work, that they wouldn't act and feel otherwise if they could. Certain it is that once the new employee gets his badge he becomes a different person; he becomes one with a responsibility and an essential job to perform, one with a chance for bettering himself in an industry whose future is as limitless as the sky.

Thus in Pratt & Whitney Aircraft at least, defense pressure, instead of creating confusion and a tangle of internal problems at the expense of production, has brought about an employee unity of purpose through self-adjustment and a desire to grow with and become a responsible member of one of the newest of essential industries.

Easier-to-Do Jobs Get Done Faster

(*Continued from page* 68)

minute with 35 operators, to 120 bottles per minute with 30 operators. The number of bottles per minute per girl has thus increased from 3 to 4, a saving of 33 percent. And the labeling job is being done distinctly better than it was before.

Besides the brand labels, each bottle must have a federal strip stamp affixed over the closure, and many states require that their own stamps be affixed before sale. Special trays are supplied for these stamp-labeling operations.

Federal strip stamps come without gum, therefore must be pasted to the bottle. The operators who apply these stamps are equipped with trays made to hold the pasting machine in the middle compartment, the supply of stamps in the left-hand compartment, and a pan of water in the right-hand compartment. The water is necessary because the operator must moisten her fingers frequently to prevent the stamps sticking to her hand. Note that the stamps are in the compartment at the left permitting the operator to pick up the stamp with her left hand, feed it through the pasting machine, and

Condor COMPENSATED HORSEPOWER

. . . all drive and a yard wide

Condor Compensated—the belt with equalized ply stresses—regardless of width, transmits power effectively, long and economically. It has the stamina for overloads; exclusive construction features provide 12 advantages—which make Condor Compensated a production asset.

Write for Bulletin 6808-D.

12 ADVANTAGES

1. Ruptures in outside ply eliminated.
2. Freedom from ply separation.
3. Longer fastener life.
4. Can be operated on smaller pulleys.
5. Less bearing, shafting, and hanger troubles.
6. For heavy loads, plies may be increased with same pulleys.
7. Operations less affected by atmospheric conditions.
8. Higher overload capacity or margin of safety.
9. Less wear on pulley side.
10. Can be dressed without injury to belt.
11. High production efficiency.
12. Material reduction in belting costs.

KEEP AHEAD WITH MANHATTAN

THE MANHATTAN RUBBER MFG. DIVISION
OF RAYBESTOS-MANHATTAN, INC.
33 Townsend Street • Passaic, New Jersey
Birmingham · Chicago · Cleveland · New Orleans · New York · Boston
Minneapolis · Detroit · Pittsburgh · Philadelphia · St. Louis · San Francisco

SECURE FOOTING

. . . safe traction and easy walking

WHEREVER men walk or work, where a tumble or fall might result in a serious accident, where industrial trucks must move safely and quickly, that's where you can put U·S·S Multigrip Floor Plate to work for you.

Multigrip's scientifically designed risers are at right angles to one another, giving a maximum of non-slip floor surface with traction for workmen's feet in every direction.

Widespread use in every type of industrial plant has proved Multigrip to be a most efficient, safe and economical flooring under all conditions of service. And Multigrip is easy to clean . . . because there are no corners to catch dirt. Write us for complete details.

U·S·S MULTIGRIP FLOOR PLATE

CARNEGIE-ILLINOIS STEEL CORPORATION
Pittsburgh and Chicago
Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
Tennessee Coal, Iron & Railroad Company, *Southern Representatives*
United States Steel Export Company, New York

UNITED STATES STEEL

onto the bottle—which remains on the conveyor.

Most state stamps are decalcomanias, and come on the face of sheets of processed paper. They must be loosened from the paper by a light soaking. Then the paper is slipped out from under, letting the stamp stick to the shoulder of the bottle. This, too, is done without taking the bottles from the conveyor as they pass.

The old method was to give each operator an aluminum serving tray in which to keep water. She usually laid several decal sheets in here at one time. The trays took up too much space on the conveyor table. The method of soaking several sheets at a time got most of the sheets too wet. Then the decal stamps lost their adhesive quality, and some of them slid off into the water and were lost.

Specially Designed Trays

In equipping the new packaging department, Calvert engineers designed a tray 15x24 inches. It projects 5 inches out from the table, serves two decal operators. The outer half is divided into three compartments. The middle compartment is for dry sheets of state stamps. On each side of the stamp compartment is a container for water, the size of the stamp container. The entire half of the tray farthest from the operator presents a surface of ¼-in. stainless steel netting. The operator dunks a sheet of stamps briefly in her water compartment, lays the sheet on the grill to drain. The run-off water re-enters the water compartments through small openings.

Proper use of this equipment gives the decal sheets exactly the right stage of wetness when the operator uses them. She lifts the moist sheet from the drain with her left hand, whisks another sheet through the water and to the drain with her right hand. Then she begins holding the working sheet with her right hand, sliding the stamp off the sheet and pressing it on to the bottle with her left thumb, sliding the paper out from under the decal with her right hand, and repeating the cycle.

The operation has been thus simplified so that four girls handle 120 bottles a minute, or an average of 2 seconds per operation, where previously the same number of girls were working as hard to handle 105 bottles, or 2.28 seconds per operation. Now all the stamps reach the bottles instead of some going down the drain—an appreciable saving, since many of the tax rates represented by the decal stamps are rather stiff.

A method standard in all Calvert bottling departments is in itself a neat job of motion economy. As is standard in many bottling plants, the bottles

● HAND CHAIN HOISTS—Ball bearing spur-geared hoists of this type are available in capacities from 300 lbs. to 40 tons.

● ELECTRIC WIRE ROPE HOISTS—Capacities ¼ to 10 tons. Electric hoists speed lifting jobs as much as 60%, cut costs as much as 90%.

Modern MATERIALS HANDLING

THE PROVEN FORMULA FOR FEWER DELAYS IN PRODUCTION ★ ★ ★ ★ ★ ★ ★

With today's urgent need for swift production—there must be no unnecessary delays, no waste of men or materials.

A proved formula for eliminating these delays, this waste, can be found in modern handling—handling that gives full control over the flow of materials in production, over lift and shift.

Tools to exercise this control take several forms, depending on the items to be handled and the amount of lift and shift required. On this page are illustrated four types of such equipment—hand and electric hoists, hand lift trucks and electric industrial trucks.

Each of these types (and its modifications for particular jobs and industries) is a tested ingredient of the formula for better, faster, more efficient production. Each, by controlling the flow of materials, by combining small units into larger units, by speeding operations, is contributing its part to Defense Production, and our collective security.

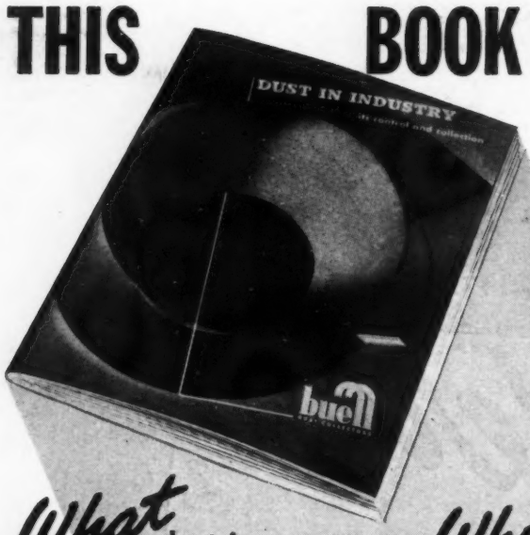
Full and complete information concerning any of this equipment, or about any materials handling problem, may be had from the nearest representative of, or by writing direct to: The Yale & Towne Manufacturing Company, Philadelphia Division, Philadelphia, Pa.

● ELECTRIC INDUSTRIAL TRUCKS—Capacities up to 30,000 lbs. A wide range of types is available to perform all transportation and lifting tasks.

TRADE YALE MARK

● HAND LIFT TRUCKS—Capacities up to 20,000 lbs. Single or multiple stroke lifts give these trucks an increased range of utility where heavier loads are concerned.

THIS BOOK TELLS...



What dust is...
in terms of both theory and practice in industry.

Where dust originates...
in the many operations of industry, such as crushing, combustion, drying, grinding, mining, powdering, roasting, sand blasting and many others.

How Buell Dust Collectors can help your business...
through the high collection efficiency of the van Tongeren System (exclusive with Buell) and the low cost of both installation and operation.

Why dust control is important...
in terms of valuable dust that may be reclaimed and reworked, and in the elimination of hazards and hindrances to production.

Who buys Buell equipment...
the great names among America's industrial leaders who have bought—*and re-ordered*—Buell Dust Collectors for a wide range of uses.

Your copy of "Dust In Industry" will be sent upon request, without obligation. Have your secretary ask for Bulletin FA-6.

buell
DUST COLLECTORS

BUELL ENGINEERING CO., INC.
12 Cedar Street, New York
Nation-wide service through offices of either Buell Engineering Co. or B. F. Sturtevant Co.

come from the maker in unsealed cartons. The empty bottles are removed from the cartons at the head of the bottling line, then when filled and labeled are repacked in these cartons.

The Calvert technique brings the cases of empty bottles in on a chute that slides an incoming case to working position where it is needed on the table surface, level with the conveyor that will carry away the bottles. The operator at this station inverts the case, in which the bottles had been packed upside down. Thus, the bottles stand upright on the table, and the operator lifts the carton off them. The take-away conveyor—a cleated booster belt carrying empty cartons to the packing end of the bottling line—is directly above the operator's head. He lifts the empty carton, now very light, to this moving belt. Meanwhile the girls who work at this station have placed the bottles on the chain link conveyor that carries them into process, evenly spaced, in single file. Hence, when the man turns his body back from lifting the empty carton to the take-away conveyor, he is ready to accept another case of empty bottles from the incoming chute.

At the Packing Station

The procedure at the end of the packing line is similar, except that it is unnecessary to handle a filled carton, hence no man is required. Enroute to this point the bottle line has been split into two files. The empty cartons come from overhead in a chute, to the packing station at the end of the production belt. The chute has metal guards on both sides except for a carton length at the very ends, for the easy removal of the carton. The packer on one side of the conveyor table reaches her hand a few inches above her head and pulls down an empty carton, sets it on a roller conveyor below her waist level, places in it bottles from the table conveyor. Meanwhile, the packer on the opposite side of the conveyor table pulls down a carton for her own use, starting an identical cycle. When a case is packed, a slight shove starts it on the gravity roller conveyor to the live infeed that takes it through the carton-closing machine.

The inspection method formerly employed was to have on one side of a conveyor three operators, each of whom lifted two bottles at a time, inverted them, inspected them while holding them against a lighted background, and replaced them on the moving conveyor. The new plant adopted an inspection method that permits two girls to inspect as much as three girls did previously.

In the middle of the table, between the two files of passing bottles, is a

"YES—AND IT HAS PROVED FAR MORE ECONOMICAL THAN THEY EXPECTED"
"SURE IS A COMPACT DRIVE ARRANGEMENT WITH THAT MOTOREDUCER THERE . . ."

Philadelphia LIMITORQUE CONTROL
operates all types of valves, etc., safely, economically, from convenient stations.
Philadelphia WORM GEAR SPEED REDUCER
right angle drives—vertical or horizontal. Wide range of ratios and horsepowers.
Philadelphia HERRINGBONE SPEED REDUCER
for heavy loads at high speed. Single, Double, Triple Reductions, various ratios and horsepowers.
Philadelphia MOTOREDUCER
The economical self-contained drive. Horizontal or Vertical types — various ratios and horsepowers.
Philadelphia GEARS
All types and sizes of industrial gears. Can be supplied in all materials.

● Just read the reasons why you get super-economy in these direct-connected drives for machines or line shafts:

The Philadelphia MotoReduceR is versatile in application to any type of equipment —under practically any condition — always giving high efficiencies.

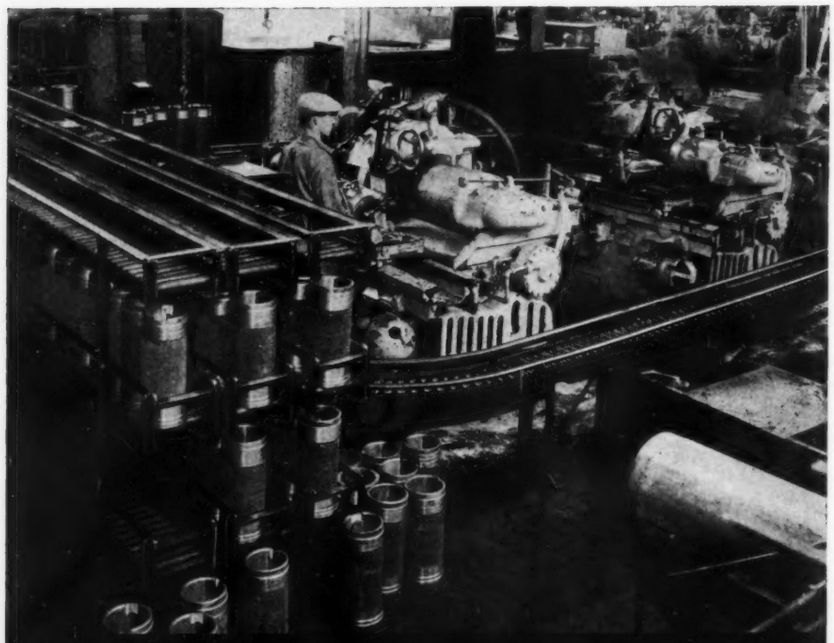
Being simple in design and construction, with all parts readily accessible, also having ample and automatic lubrication, the maintenance cost is negligible.

The MotoReduceR is available in a wide range of ratios and horsepowers. . . . Consider its application to your requirements. Our latest descriptive literature will point out its economy — write us.

PHILADELPHIA GEAR WORKS

Industrial Gears and Speed Reducers
Erie Ave. and G St.
Philadelphia, Pa.
●
New York • Pittsburgh • Chicago

To Move THINGS QUICKLY—ECONOMICALLY



Mathews CONVEYER SYSTEMS

● Today—the call to arm demands speed—and still more speed. You must have increased production—and Mathews can assist you in getting it. A Mathews Engineer can show you how to speed production and at the same time conserve man power.

INCREASED CAPACITY FOR NATIONAL DEFENSE
Our plant capacity has been increased over 65% to care for the rising demands of the National Defense Program—plus the normal demands of peacetime production.
All orders, whether subject to Defense priorities or not, are given the same helpful care and attention that have always marked our dealings with prospects and customers in the past.

MATHEWS CONVEYER COMPANY
120 TENTH ST. - - - ELLWOOD CITY, PA.

Field Engineers and Sales Offices located in 30 Industrial Centers.

box screened to provide a bright field of diffused illumination facing toward both sides of the conveyor. An inspector sits before a 14″ magnifying glass, looks through this glass and through the passing bottles. If any bottle's contents are less than crystal clear, or if a glass defect exists, she removes the bottle. Saving: 33 1/3 percent in inspection time, no motion fatigue.

Excepting the floor, chair seats, and conveyor tables, there is hardly a horizontal surface in the packaging department. The purpose, of course, is to eliminate accumulation on the usual flat surfaces such as window sills, machine tops, and the like, of the personal belongings which employees had much better leave in their lockers. When the bottle-filling machines were delivered, with flat tops, the management substituted rounded tops. Consequence of this policy is that the room is utterly uncluttered by conversion materials and "chattel goods."

Posture Chairs for All

Customary seating for operators on the company's bottling lines used to be old-fashioned metal stools. The new plant provides posture chairs for all operators, adjustable by the individual as to height and angle of back, and height of seat.

There is no way to measure the effect, because these chairs have been used ever since the plant began operation last fall, and their influence on production cannot be isolated from the influence of the other variables which shifted at the same time. However, the plant employees generally admit to less fatigue at the end of the working day, despite the increased production per worker. The management's explanation is that instead of dissipating their energy in holding themselves in working position as is necessary when the obsolete seats were used, the employees now gain bodily support from the posture chairs. Thus is increased the proportion of the day's energy employed productively.

●

BOOKS

RUNNING A MACHINE SHOP

Fred H. Colvin, Editor Emeritus, "American Machinist," and Frank A. Stanley, Editor, "Western Machinery and Steel World." McGraw-Hill Book Co., 330 W. 42nd St., New York. 449 pages, photographs, diagrams, tables, index. $3.50

A comprehensive book of plans and methods which have proved themselves in general machine shop practice. Covers problems of planning a shop, selecting and maintaining machinery, using materials handling equipment, storing and issuing tools, routing and controlling work, estimating, training, managing, and inspecting. A thoroughly practical manual for managers or owners of large or small machine shops. Diagrams show exact plant layouts and production lines. Management, apprentice training, and per-

"COUNT OFF!"

ON VEEDER-ROOT DEVICES

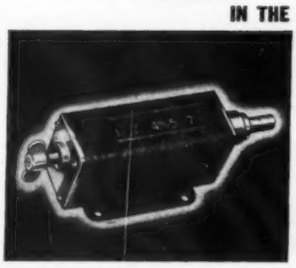
. . . make sure production is "all present and accounted for"

This is the order of the day . . . in the armed forces . . . and in the industrial plants that are racing time to arm and supply them! *Make it count!* Put every stroke of work down in black-and-white, and you can spot the bottlenecks, loosen them up, cut costs, control quality, speed production . . . in sum, you can do your bit more effectively toward getting this country prepared *in time*. Today, Veeder-Root Devices have been enlisted in a special Defense Program against waste and inefficiency in every line of industry. And you can draft them into your own service, too. The number to call is Hartford 7-7204.

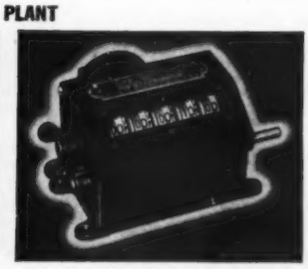
VEEDER-ROOT INC., HARTFORD, CONN.

OFFICES IN: Boston, Chicago, Cincinnati, Cleveland, Detroit, Greenville, S. C., Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis, San Francisco, Montreal, Buenos Aires, Mexico City, London, Paris, Tokio, Shanghai, Melbourne. IN ENGLAND: Veeder-Root Ltd., Croydon, Surrey. IN CANADA: Veeder-Root of Canada, Ltd., Montreal

IN THE PLANT

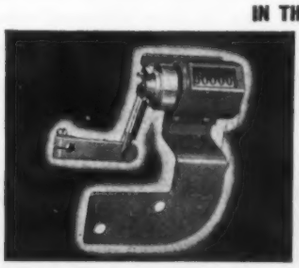


For High Speed Work: This High Speed Reset Counter runs at 8,000 counts per minute in direct-drive type; 2,000 counts in revolution type.



Controls Machine Runs: Predetermining Counter prevents over-runs and shortages on winders, fast automatics, running up to 2,500 r. p. m.

IN THE OFFICE



Accounting & Typing: This Production Computator records keystrokes on typewriters and accounting machines, provides a fair basis for wages.

For Office and Light Production Machines: Small Reset Counters count strokes or revolutions. May be furnished with totalizing register if desired.

KEEPING PACE WITH *America's* REQUIREMENTS

WE all realize that in the interest of National Defense, the resources of industry and the Nation must be utilized with maximum efficiency and minimum waste. So in affording long-lasting, metal-like protection to surfaces of all types, against the destructive forces of heat, cold, wind, rain, acids and fumes, Permite Ready-Mixed Aluminum Paints are rendering a more vital service than ever.

While the needs of the Defense Program take precedence, we are taking care of the ready-mixed aluminum paint requirements of our customers in all lines as rapidly as raw material supplies and production capacity permit.

In our desire to catch up with demand, we are rapidly expanding our production facilities. And our research and laboratory staff is keeping step, so that in the future as well as today you can always depend upon Permite quality.

ALUMINUM INDUSTRIES, Inc., Cincinnati, Ohio
DISTRIBUTORS IN PRINCIPAL CITIES

PERMITE *Ready-Mixed*
ALUMINUM PAINTS

sonnel relations are among the chapter headings. Actual forms for requisitions, shop orders, records, are shown. A 47-page index gives easy reference to any particular problem.

LABOUR POLICY IN GERMANY UNDER THE NAZI REGIME

P. Waelbroeck and I. Bessling. International Labour Office, 734 Jackson Place, Washington, D. C. 26 pages. 10c.

Study and history of Germany's labor policy under the leadership of the National-Socialist party. Describes the coordination and centralization of administration, vocational training, mobilization of labor reserves, control of labor distribution, organization of industrial relations, regulations of wages and hours of work, from 1933 until after the beginning of the present war.

EMPLOYMENT STABILIZATION

Editors of the Prentice-Hall "Unemployment Insurance Service." Prentice-Hall, Inc., 70 Fifth Ave., New York. 71 pp. $1.

Subtitled "How to Stabilize Employment for Payroll Tax Savings," booklet is divided into three parts: (1) Explanation of Merit Rating for Stabilization; (2) How to Stabilize Employment; (3) Case Study of Employment Stabilization. Pointing out the savings to be gained by companies which, by judicious transferring of employees from one department to another, and other means, earn merit ratings. Gives methods and actual cases showing how employment levels can be stabilized, throughout the year.

PREPAYMENT PLANS FOR MEDICAL CARE

Franz Goldman, M. D., Joint Committee of the Twentieth Century Fund and the Good Will Fund; and Medical Administration Service, Inc., 1790 Broadway, New York. 60 pages, tables, appendix. 25c.

ON THE CALENDAR

JUNE

1–6, Society of Automotive Engineers, Summer Meeting, White Sulphur Springs, W. Va. C. B. Whittlesey, Assistant Secretary, 29 West 39th St., New York.

16–19, American Society of Heating and Ventilating Engineers, San Francisco. A. V. Hutchinson, Secretary, 51 Madison Ave., New York.

16–20, American Society of Mechanical Engineers, Semi-Annual Meeting, Kansas City, Mo. Ernest Hartford, 29 West 39th St., New York.

16–20, American Institute of Electrical Engineers, Summer Convention, Toronto, Canada. H. H. Henline, Secretary, 33 West 39th St., New York.

23–27, American Society for Testing Materials, 44th Annual Meeting and Exhibit of Testing Apparatus and Related Equipment, Chicago. B. E. Hess, Assistant Secretary, 260 South Broad St., Philadelphia.

30–July 3, Conference on Mechanical Engineering Instruction, cooperative project of S.P.E.E. and A.S.M.E., Purdue University, Lafayette, Ind. Professor E. S. Ault, School of Mechanical Engineering, Purdue University, Lafayette, Ind.

JULY

23–26, Silver Bay Conference on Industrial Relations, 24th Annual Conference, Silver Bay-on-Lake George, N. Y. E. H. T. Foster, Executive Secretary, 347 Madison Ave., New York.

AUGUST

27–29, American Institute of Electrical Engineers, Pacific Coast Convention, Yellowstone National Park. H. H. Henline, National Secretary, 33 West 39th St., New York.

UNIVERSITY SUMMER COURSES FOR EXECUTIVES AND ENGINEERS

June 9–27, Summer Management Course devoted to Production Planning, Motion and Time Study, and Related Subjects, University of Iowa. Ralph M. Barnes, College of Engineering, University of Iowa, Iowa City.

WHEN DELAYS ARE COSTLY...

WEBSTER ELECTRIC Teletalk

REG. U.S. PAT. OFFICE

PAGING SYSTEMS

Locate busy executives quickly the modern way—with amplified voice paging

● Nothing arrests a man's attention so quickly as hearing his name—voice paging gets him instantly without interrupting others or distracting their attention. No pausing to count bells or buzzers or flashing lights... Teletalk speaks in a clear, unmuffled voice as loud or as soft as the various speaker locations demand —adjustable from a whisper to a booming crescendo.

With Teletalk Amplified Paging every one of your executives is in instant reach from the call station, no matter where he may be in the plant. Teletalk Paging is available with 12 and 24 stations . . . the operator can call over one, a selected group, or all speakers simultaneously . . . and actually deliver messages instead of merely signalling.

Put a Teletalk Paging System in your plant NOW to stop waste motion, unnecessary interruptions and costly delays. We have speakers for indoor and outdoor locations, with booster amplifiers and all other equipment necessary for noisy locations and unusual requirements. Ask your nearest jobber, or write for detailed information.

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WEBSTER ELECTRIC COMPANY, Racine, Wis., U.S.A. Est. 1909. Export Dept.: 100 Varick St., New York City. Cable Address: "ARLAB" New York City

WEBSTER ELECTRIC

"Where Quality is a Responsibility and Fair Dealing an Obligation"

MANUFACTURERS OF TELETALK INTERCOMMUNICATION AND PAGING SYSTEMS • POWER AMPLIFIERS AND SOUND DISTRIBUTION EQUIPMENT • RADIO PHONOGRAPH PICKUPS • IGNITION TRANSFORMERS AND FUEL UNITS FOR OIL BURNERS

Here's the Little Device that

TELLS YOU WHEN EACH MACHINE STOOD IDLE —AND *How Long!*

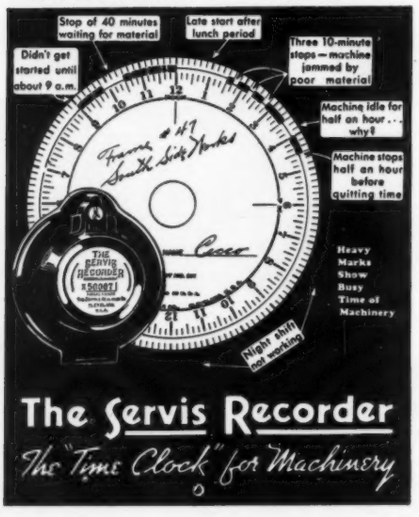
What does it cost you when machinery is idle for half an hour when it might have been producing? Suppose you could increase its running time merely 10 minutes a day. What would it mean? More than you'll ever save by "little economies."

The *big* economy in any plant is to increase productive time, if only five per cent.

You don't have to hold a stop-watch to do it. Clamp a *Servis Recorder* right to any machine and leave it there. Leave it all day. The next morning ask for the chart. No mistakes here. Your machinery has automatically written its own story for 24 hours. You can read it at a glance — busy time — idle time.

Write for folder "A Busy Plant"

THE SERVICE RECORDER CO.
1375 Euclid Avenue Cleveland, Ohio


Stop of 40 minutes waiting for material
Late start after lunch period
Three 10-minute stops — machine jammed by poor material
Didn't get started until about 9 a.m.
Machine idle for half an hour . . . why?
Machine stops half an hour before quitting time
Heavy Marks Show Busy Time of Machinery
Night shift not working
THE SERVIS RECORDER

The Servis Recorder
The "Time Clock" for Machinery

They Say and Do

Business Interruption Insurance Gets New Emphasis

The transition of industry to an all-out defense footing has laid new emphasis, the underwriters say, on business interruption, or "use and occupancy," insurance.

The uncertainty of obtaining plant machinery replacement is given as a leading cause. Where, a year ago, 60 days might have been the estimated time required for replacement, the loss today might mean a year's idleness, or even a complete shutdown.

Business interruption insurance, initiated over 25 years ago, is a supplement to insurance covering actual loss to the buildings which house machinery or stock. It protects against loss because of a halt in production and sales, the potential loss being estimated in terms of time and then translated into terms of dollar loss.

"Insurance men say that today more and more manufacturers and merchants are carrying not only fire and use and occupancy insurance, but also insurance protecting them against other hazards, such as riot and civil commotion insurance (including full explosion coverage), smoke damage, and property damage to the establishment caused by falling aircraft," the *Wall Street Journal* reports.

•

New Abbreviation Standard Issued by Association

Offhand, you may or may not recognize instantly the meaning of "Kgps." This is not a misprint, it is the accepted abbreviation for kilograms per second in the recently completed new revision of American Standard Abbreviations for Scientific and Engineering Terms.

The engineers, editors, and scientists collaborating in the work of the American Standards Association have added many new terms to "the shorthand of engineering and scientific language" in the new edition. The first publication was issued in 1932.

Leadership in this work has been taken by a committee representing the American Association for the Advancement of Science, the American Institute of Electrical Engineers, the American Society of Civil Engineers, the American Society of Mechanical Engineers, and the Society for the Promotion of Engineering Education. Besides including abbreviations for terms not previously covered, the new edition shortens some of the previously recommended abbreviations.

For example, in the new standard, the 1932 shortcut "lb. per sq. in." has been shortened to "psi" (without a period).

Other characteristics of the standard are: "Elimination of spaces between word combinations or letters, and elimination of periods, except in cases where the abbreviation spells out a common English word. For example, the abbreviation for barometric is "bar." (note period), while the abbreviation for calorie is "cal" (without a period).

•

Shipbuilder Gives Navy 50 Percent of Profit

The Associated Shipbuilders of Seattle, Wash., got a $1,750,000 contract for converting a passenger liner into a troop transport.

A little later on the company received a contract totaling about $17,000,000 for the construction of seaplane tenders, whereupon the company found that the new volume of orders had so decreased its overhead as to render inaccurate its estimate of profit on the first order. Hence, the company voluntarily returned to the Navy 50 percent of its originally estimated profit on the initial order.

"Such cooperative and patriotic action should rightfully be brought to the attention of the American public," said Ralph Bard, Acting-Secretary of the Navy, in announcing the Seattle company's decision.

•

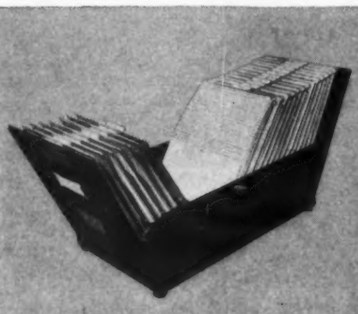
Labor Costs Are Studied From Tools to Soda Pop

Machine tool accessories stand highest, while carbonated beverages are at the bottom of the list, in a recent analysis of labor costs in 30 American industries. Vast differences in labor costs are revealed in the study, which was conducted by the Federal Trade Commission.

Second only to machine tool accessories are steel castings, while steel milling stands seventh. This finding holds extra interest because of recent wage increases throughout the steel industry.

A limited but representative number of plants were surveyed in each of the industries studied. The study showed

Meeting the Needs of the Hour!



KOLECT-A-MATIC

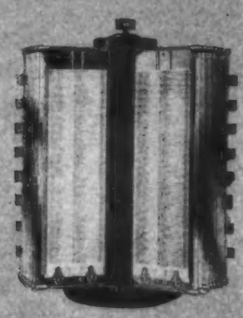
TOOL CONTROL becomes effective, rigid and accurate when a visible Kolect-A-Matic or Kardex system is utilized. These visible systems assure maximum tool utility with less time lost in waiting for tools to become available, stop thefts, reduce damages.

SAFE-FILES

Engineering and specification files, with VISIBLE charge out controls, housed in Safe-Files have the triple advantages of fast filing, positive finding and protection from fire and sabotage at the "point of action."

FLOOR MODEL SAFE KARDEX "60"

PERSONNEL problems can be greatly lessened through the fast, visible reference features of this unit. Applications and job requisites are quickly matched. Conforming with governmental identification regulations is simplified.

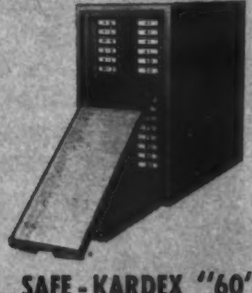


INDEX VISIBLE

"MACHINE LOADING" records in Index Visible equipment instantly disclose the number of hours of work, by job, assigned each machine or department. The result is balanced operation and unbroken schedules.

SAFE-CABINET

PLANS and SPECIFICATIONS that must be kept flat and unwrinkled are ideally housed in fire-insulated Safe-Cabinets. VISIBLE control indexes add security from loss or sabotage.



SAFE-KARDEX "60"

PLANNING, PRODUCTION and INVENTORY control records in Safe-Kardex "60" provide maximum efficiency with minimum trouble shooting and order chasing. Fire protection at "point of action" is a PLUS value.

PREPAREDNESS IS THE PRICE OF SECURITY!

NOW, while National Defense production pressure puts the heat on your operations, is the time to tighten up your methods and systems.

Bottlenecks, inefficiency and slackened production have been traced in many case histories directly to routines and record keeping systems. Remington Rand will put the experience of solving these costly problems at your disposal.

On this page are a few of the Remington Rand products that will help you simplify your record procedures—and meet the needs of the hour!

•

FIND OUT TODAY HOW REMINGTON RAND CAN HELP YOU

Whether your record problems are concerned with Production, Maintenance, Inventory, Personnel, Accounting or Procurement, Remington Rand has solved similar problems for other organizations. Get this experience free!

MAIL COUPON TODAY

Remington Rand Inc.
Dept. FM6-41
Buffalo, New York

Send full information and sample forms on the following records:.....

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Name.....

Company.....

Address.....

City and State.....

REMINGTON RAND INC.
BUFFALO · NEW YORK
BRANCHES IN ALL PRINCIPAL CITIES

HIGHER TEMPERATURES TO
Speed Up FINISHING!
ROSS
AIR HEATERS
INDUSTRIAL OVENS
Faster finishing can meet your need for increased capacity without enlarging your plant. Ross Air Type Heater Systems by safely increasing and controlling baking temperatures greatly reduce the baking time.
In the automobile and other industries Ross Air Heaters and Ovens have made possible substantial savings in fuel cost, floor space and investment in equipment. They have secured better quality of output, greater flexibility and absolute thermostatic control.
Recommendations by Ross are based upon long experience with finishing problems. We maintain complete laboratory facilities. Consult us on your requirements.
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0° TO 1000°
Write for these Books
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J. O. ROSS ENGINEERING CORPORATION
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321 North Wells St. CHICAGO, ILL.
12323 Greeley Ave. DETROIT, MICH.
ROSS ENGINEERING OF CANADA, LIMITED, Dominion Square Building, Montreal

that in seven machine tool accessories shops, labor costs averaged 32.6 percent of the price of the product. The next nine highest classifications, with the percentage of cost of each, follow: steel castings, 31.8 percent; knit goods, 29.3; firearms, ammunition, 29.1; electric machinery, 28.5; clothing, 26.2; steel, 25.2; tools, 24.9; clay products, 24.2; carpets, rugs, 23.2.

In the group ranging downward from 22.4 percent to 12.2 percent and in the order named were: engines, office devices, boots and shoes, paper, heating and cooking equipment, copper, refrigeration and air conditioning, railroad equipment, machinery, gypsum and asbestos roofing, radio, biscuits and baking, tin cans and tinware, and domestic laundry equipment.

At the bottom of the list were: canning, 9.3 percent; petroleum, 8.4; paint, 6.5; milk, 5.0, and carbonated beverages, 2.9.

•

OPM Posters Offered to Defense Plants

"We, the people . . . ARM FOR DEFENSE" is the simple legend emblazoned on the first of a series of posters just issued for display in defense plants by Office of Production Management.

With a blue background, these words, in white, are embellished with a red-and-white outline drawing symbolic of defense industry and reminiscent of NRA's Blue Eagle. Copies are available through the Division of Information, Office for Emergency Management, Washington, D. C.

In the offices of OPM, by the way, hang a number of roughly-lettered signs, evidently the work of enthusiastic amateurs. These read: "Don't get caught with your plants down."

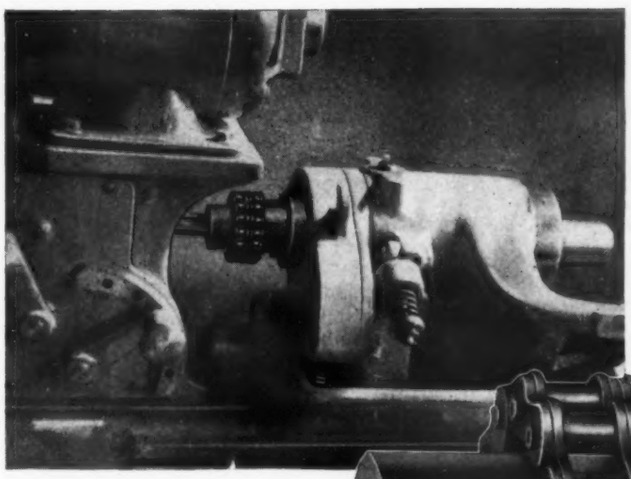
•

Posters Urge Training of Skilled Men

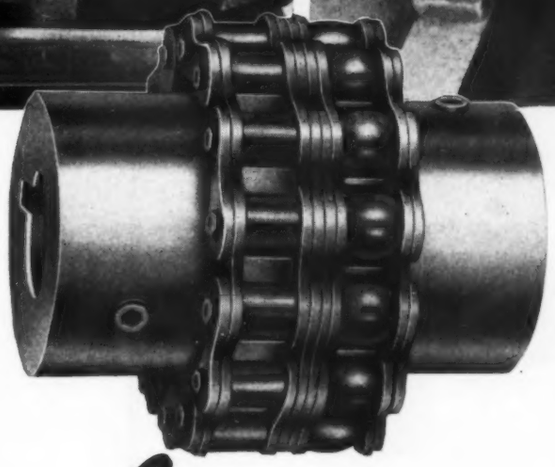
"When any man adds a single hour to the production life of a tool, or makes that tool do better work, that man makes a worth-while contribution to American ideals and to America's future."

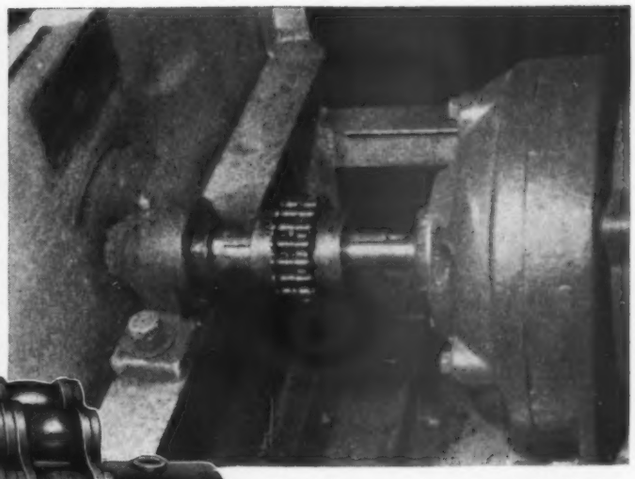
So reads the message on a handsome plant poster, 12 x 17 inches, now being offered without charge for display in plants wherever desired. The foreground figure is that of a muscular American wage earner standing out against a background of mingled industrial and defense symbols.

"The responsibility for training new men in the use of tools should lie with the manufacturers of these tools." That is a firm conviction of Charles J. Koe-



POWER TRAVELS *through a Baldwin flexible coupling to accommodate necessary misalignment on this machine tool.*





ALL IS QUIET *on this blower unit since a Baldwin coupling replaced another whose noise and early wear due to backlash put it on the "black list."*

THERE'S NOT ANOTHER *like it! This patented Baldwin flexible coupling is the only chain belt coupling that's* truly *flexible, yet completely free from backlash!*

Now! True Flexibility

WITHOUT DESTRUCTIVE BACKLASH!

●You may have been using so-called "flexible" couplings for 30 years; you may have legitimate claim to more knowledge of ordinary coupling performance than we have; but if you have, you'll be all the more interested when we say:

"Mister, you haven't seen anything yet!"

By "anything" we mean *any* coupling that can equal the performance of this unique, *truly flexible* Baldwin chain belt coupling.

Here's a coupling that has built-in flexibility—without backlash—it *has* to wear longer! Here's an all-steel chain belt coupling whose cylindrical and barrel-shaped rollers mean *real* flexibility—up to 3° either side of center line.

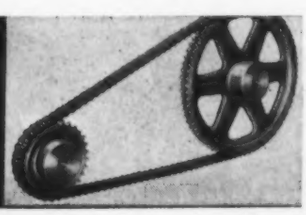
Call the Baldwin man! Try a Baldwin coupling—see if it doesn't run quieter, smoother, accommodate more misalignment and *still* last longer than any you've ever known! Then you'll see why it pays to standardize on Baldwin flexible couplings throughout your plant.

GET THIS BOOK

AND GET THE FACTS!

Here's the whole story about the design and proper application of roller chain belt flexible couplings for all standard and many special requirements. Complete with prices, dimensions, horsepower tables, service factor tables and other useful information, this book contains many valuable hints for anyone responsible for the low-cost, trouble-free operation of plant machinery. Write to the address below, or call the Baldwin man.

BALDWIN
CHAIN BELTS



Please address your inquiry to:

BALDWIN-DUCKWORTH
Division of Chain Belt Company
327 Plainfield St., Springfield, Mass.
Factories at Springfield and Worcester, Mass.

LET'S PLUG IT IN ...Speedily!

Throwing the production capacity of this country into full swing—putting the country's mighty resources to work—PLUGGING IN the industrial machinery of the USA—that is today's big job.

It is a job that must be tackled with determination by every branch of the electrical industry.

To aid National Defense, Roebling has "plugged in" its facilities. Roebling plants are operating day and night—at full capacity.

Equally important, Roebling is unceasingly maintaining the high standard of quality for which Roebling electrical wires and cables are noted—a standard of quality that is a safeguard against shutdowns and delays, that assures all-around dependable service.

JOHN A. ROEBLING'S SONS COMPANY

TRENTON, NEW JERSEY

ROEBLING
ELECTRICAL WIRES AND CABLES

bel of the Koebel Diamond Tool Company of Detroit. Hence the poster, free of all advertising matter, which Mr. Koebel is offering for plant display. Hence also a well-conceived booklet, "For Grinder Men Only," which Koebel also offers without charge to those who have a use for it. "For Grinder Men Only" gives simple, fundamental instruction in wheel dressing for grinder operators. The brief, concise text is embellished with racy and appropriate illustrations.

•

Defense Obstruction Laid to Lewis by Green

The 10-year-old feud of John L. Lewis and William Green still rages unabated, though it takes new turns in the fast-developing changes of the present day.

Green, much beset by critics of his own organization, can always find a shaft in his quiver for Lewis. This has been especially true in the recent months of the defense emergency.

Green seized promptly upon a statement made not long ago at Harrisburg, Pa., by Lewis, in which the still active CIO leader was reported as saying to the government, "Don't expect too much cooperation from labor."

Visiting Harrisburg almost on Lewis's heels, Green declared:

"On behalf of the five million members of the American Federation of Labor, I utterly and completely disavow every word of the statement by Mr. Lewis . . . Mr. Lewis, in his speech, referred sneeringly to the present conflict in Europe as an 'unnecessary imperialistic war.' That may be his opinion. It is also the policy of the Communist Party so to regard it. But that definitely is *not* the opinion of American workers as represented by the American Federation of Labor. We stand unanimously on the side of Great Britain and the other democracies in their struggle against totalitarian aggressors. We believe our country should extend every aid possible to these democracies."

Green then renewed his frequent charge that Philip Murray, new CIO president, is a silent figurehead in CIO, of which Lewis remains the real leader. Was Lewis, Green asked, speaking for CIO—or merely for himself?

"The man who must answer that question is the man who bears the title of president of the CIO," Green asserted. "He was the honored guest at the function which Mr. Lewis addressed. The nation has not heard a word from him since. Silence, as all of us know, means consent."

The bad blood between Lewis and Green came to a new boil in the rival

PROVED THROUGH 20 YEARS!

(Above) Dr. Willis H. Carrier, who developed Centrifugal Refrigeration 20 years ago, is here shown with one of the latest machines.

Carrier Centrifugal REFRIGERATION

For Economical Air Conditioning and Refrigeration

COMPARE THESE 10 CARRIER FEATURES

1. Wide range of capacities up to 1000 tons.
2. Wide range of temperatures as low as minus 130°F.
3. Applicable to all refrigeration requirements.
4. Dependability proved by hundreds of installations.
5. Minimum power consumption and unusually small refrigerant loss.
6. Low maintenance cost through simplicity in design.
7. Compact — no special foundations necessary.
8. Superior operating performance inherent in machine.
9. Refrigerant with highest A. S. R. E. safety rating.
10. Oil economy with small charge and negligible losses.

What This Engineering Achievement Means to Your Factory

• You don't have to be told about the benefits of air conditioning . . . how it maintains a higher quality standard for your products . . . steps up production . . . improves the efficiency of employees . . . reduces plant shutdowns due to poor weather. But perhaps you don't fully realize how much Carrier Centrifugal Refrigerating Machines can reduce the operating and maintenance costs of air conditioning. If this is the case, consider how Carrier Centrifugals were chosen for such leading plants as du Pont, American Viscose, U. S. Rubber, American Tobacco, Bell Telephone, Celanese, Goodrich, Eli Lilly, as well as more than 850 other companies throughout the world. Without obligation, let us send you the complete story on Carrier Centrifugals and what they can mean to you. Send coupon below now.

MOST COMPLETE INFORMATION ON CENTRIFUGALS EVER PUBLISHED

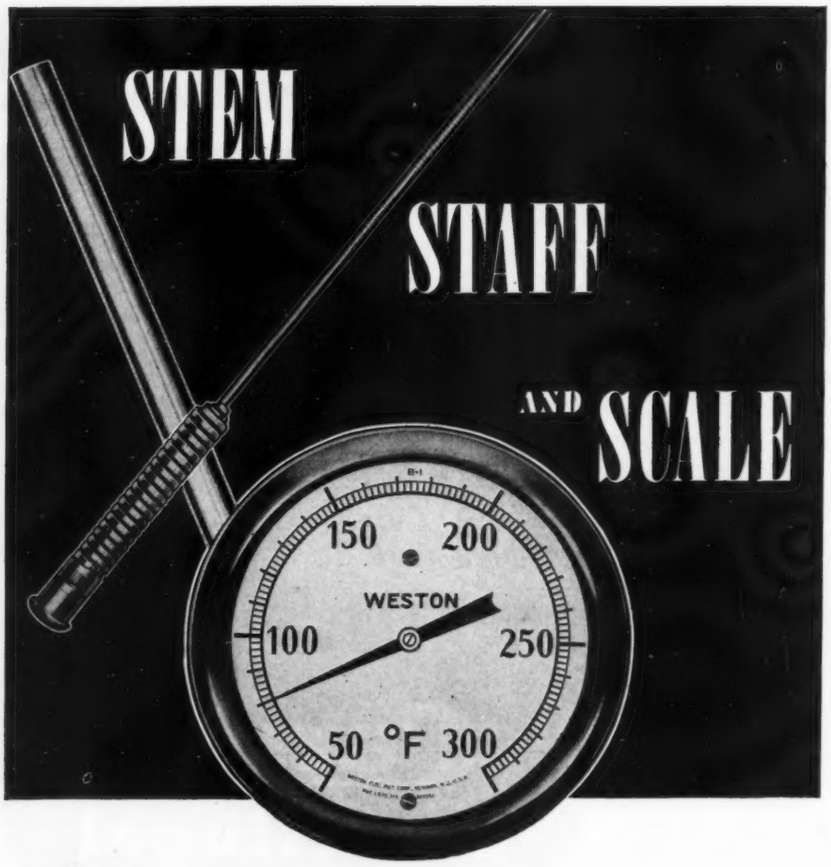
CARRIER CORPORATION Desk F33
"Weather Makers to the World"
Syracuse, N. Y.
(In Canada: 30 Bloor St., West, Toronto, Ontario)

Without obligation, please send new 42-page booklet "20 Years of Centrifugal Refrigeration."

Name.....

Company.....

Address.....



DOWNRIGHT SIMPLICITY

contributes ruggedness and long-life dependability to THERMOMETERS

Nothing complex about a WESTON Thermometer . . . no gears, no liquids or vapors, no capillary. It consists of but a few, simple parts . . . and those parts made of enduring, corrosion-resisting metal. Thus the WESTON presents fewer opportunities for trouble . . . *and sturdy protection against it.* The result is a thermometer that *maintains* its dependability over longer periods . . . with less breakage . . . less damage from overtemperatures . . . one that *costs far less, all around.*

WESTON Thermometers are guaranteed accurate within 1% over the entire scale, and require no compensation regardless of stem length. They are available in both angle and straight stem types . . . stem lengths 2" to 24" . . . scale diameters up to 6". Bulletin sent on request. Weston Electrical Instrument Corporation, 628 Frelinghuysen Avenue, Newark, New Jersey.

WESTON *ALL-METAL GAUGE TYPE* **THERMOMETERS**

claims of AFL and CIO for representation in the Ford Motor Company's plant. On the defense issue generally, both sides have made counter charges of obstructionism. At the same time, both sides have been responsible for an almost equal number of strikes on defense work. In the total number of strikers, however, CIO members have outnumbered AFL members approximately 5 to 1.

Strikes aside, AFL critics have frequently found CIO vulnerable in matters of national policy, pointing out that CIO has thrown its weight in Washington against national conscription, against the earlier large defense appropriation, and against much of the Roosevelt Administration's foreign policy. The CIO has been far more aggressive in its wage demands, far more critical of industry's profits record, and much more inclined to resist defense sacrifices than AFL. There is a "business as usual" attitude in its current demand for increased, not decreased, relief and work relief appropriations.

On the credit side is the recent action of United Instrument Workers, Local 425 of the United Electrical, Radio & Machine Workers of America (CIO). which voluntarily proposed a 60-hour week to the management of the Ford Instrument Company of Long Island City. Ford Instrument, a subsidiary of Sperry Gyroscope, holds secret naval contracts of the utmost importance to defense and faces a serious handicap through lack of ultra-skilled workers.

•

Truck and Tractor Bookings Continue at High Levels

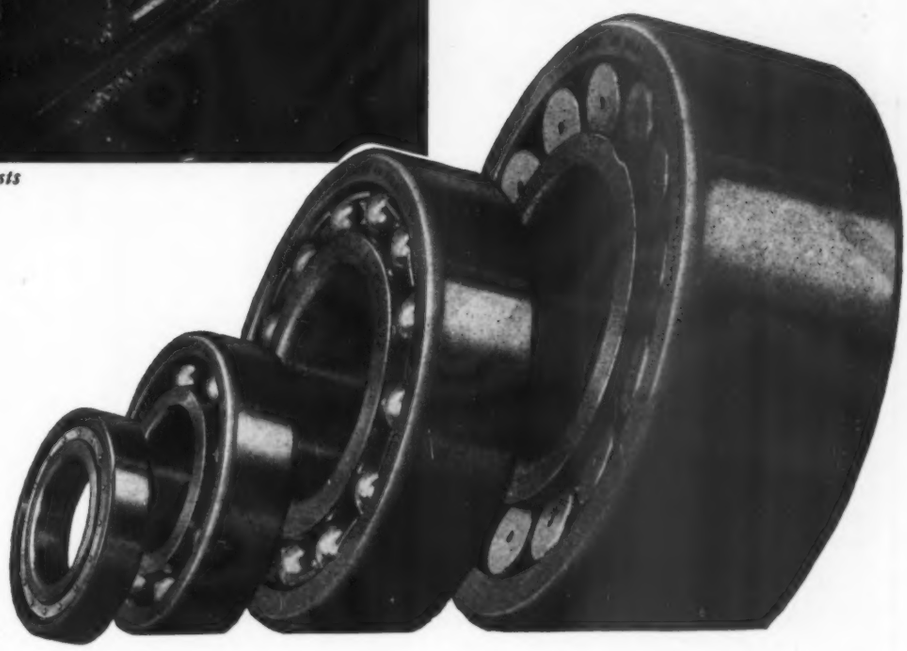
April bookings of electric industrial trucks and tractors, both in units and dollar value, continued at a high level, although somewhat lower than the peak established in February, the Industrial Truck Statistical Association, 208 South LaSalle St., Chicago, reports. April bookings total 430 units compared with 436 units in March. During the first four months of 1941, units booked totaled 1605 compared with 392 during the same period in 1940—an increase of 309 percent.

Total net value of chassis only was $1,472,225.80 during April, compared with $1,557,591.91 during March. During the first four months of 1941 the total value of bookings was $5,360,778.71, compared with $1,362,023 during the same period in 1940, an increase of 293 percent.

Thirty-one non-elevating platform trucks, with capacities and base chassis prices ranging from 4,000 to 6,000 pounds and $1,770 to $3,225 respective-

SKF *Pillow Blocks* SAY "STOP!" *to* FRICTION

Nipping high labor and lubrication costs in the bud with SKF Pillow Blocks



WE USE SKF BEARINGS

AMERICAN BLOWER CORP.

One of the most dangerous saboteurs in the Defense Industry is Friction. It lurks around *all* rotating parts. Its allies are lubricant leakage, dust, dirt, and moisture. And mindful of its presence, Industry is guarding its precious bearings with SKF Triple Seal Pillow Blocks—the housings that say "STOP!" to escaping lubricant and invading abrasive material . . . that drive FRICTION out of the plant and out of production records . . . FOREVER. 4823

SKF INDUSTRIES, INC., FRONT ST. & ERIE AVE., PHILA., PA.

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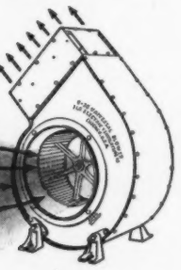
RAPID AIR CHANGE REMOVES

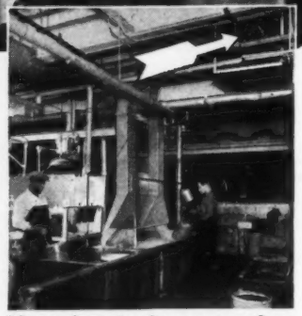
DOPEY, DESTRUCTIVE, DANGEROUS FUMES



ILG Proof of results!

No Gas Masks Here! Under complete control are the clouds of acid-bearing vapors which ordinarily would belch forth all along the line in this Chicago plating plant! ILG Direct-Connected Blowers, mounted on wall or ceiling throughout plant, swiftly draw off destructive fumes as fast as they develop. Accident hazard is reduced . . . employee efficiency increased . . . equipment depreciation (corrosion) practically eliminated.

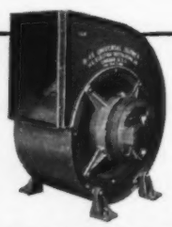
Compact, built with watch-like precision for long years of performance, ILG Blowers and Self-Cooled Motor Propeller Fans play a vital part in efficient, high-speed production. Write, or phone for demonstration—*today!*



Mounted overhead to conserve floor space in B. Mercil and Sons plant, Chicago, ILG Direct-Connected Universal Blowers immediately exhaust noxious fumes from electro-plating operations. This company started using ILG equipment 15 years ago.

ILG ELECTRIC VENTILATING CO.
2874 N. CRAWFORD AVENUE, CHICAGO, ILL.
Offices in 43 Principal Cities

ILG
Vitalized VENTILATION
AND AIR CONDITIONING
*AIR CHANGE...NOT JUST AIR MOVEMENT!



ILG DIRECT-CONNECTED BLOWERS . . . reduce space cost, installation cost, operating and maintenance costs, sound isolation cost. Wide range of sizes. "One-name-plate" guarantee. Get catalog EB-381 now!

ly, had a total net value of $66,346.62. All net values are at factories, after additions and deductions for variations from standard specifications, trade-in allowances, and so on, when applicable. There were 356 cantilever trucks, with capacities and base prices ranging from 1,000 to 20,000 pounds and $2,045 to $13,000 respectively, with a total net value of $1,249,799.44; 22 light and heavy duty tractors, base chassis prices ranging from $1,550 to $1,745, had a total net value of $35,177.94; 21 crane trucks, with capacities and base chassis prices ranging from 3,000 to 6,000 pounds at 7-ft. radii, and $4,780 to $7,450 respectively, had a total net value of $120,901.80.

The figures above are after adjustments for cancellations of 1941 bookings; January bookings canceled—one 2,000-lb. fork truck, value $3,200 and one 4,000-lb. high lift, value $3,250; February bookings canceled three 6,000-lb. low lifts, total value $7,080.

Also canceled were one 2,000 lb. platform truck valued at $3,000, one 6,000-lb. low lift truck valued at $4,285 booked in October, 1940, and two 3,000-lb. low lift trucks valued at $4,190 booked in December, 1940. No adjustment of 1941 figures has been made for cancellations of 1940 bookings.

•

Can the Government Take Over Strike-Bound Plants?

One of the great unanswered questions of defense has on several occasions come close to a test. The result is that the public now presumes that the government, under existing law, can take over the management of industrial plants in which strikes have halted defense production.

Legal experts are by no means sure that the government has such power, despite the bold pronouncement of certain officials. During the Allis-Chalmers stoppage, even Secretary of War Stimson threatened publicly that the Army might take over operation of the plant unless the management and the union (Local 248 of the United Automobile Workers—CIO) came to terms. No action was taken, and observers have wondered since what form such action might have assumed.

Careful reading of the language of the clause in the Selective Service Act reveals no apparent basis for plant seizure in strikes. In this Act, and in the 1920 amendment to the National Defense Act of 1916, the laws upon which such seizure are uniformly believed to be based, the government is authorized to commandeer plants only in the event that the management refuse to accept reasonable terms for the manufacture of war goods. Nothing

NORTON ABRASIVES

Conditioning Tools of Industry

Norton grinding wheels for the tool room—variety in abrasive, bond, grain, grade, structure—plus the Service of Norton engineers in industrial centers—always ready to meet requirements of industrial plants the length and breadth of the land.

WHEN IT'S A GRINDING PROBLEM, CALL IN NORTON ENGINEERING SERVICE

NORTON COMPANY
WORCESTER, MASS.

BEHR-MANNING DIVISION, TROY, N. Y. (ABRASIVE PAPER AND CLOTH)

Man Power

DEPENDS ON FOOD SUPPLY!

Ideal Rolling Cafeterias are built in many sizes and styles, squarely meeting every different feeding problem.

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● Save time and money by bringing food to the worker instead of making him go to the food. Use priceless floor space for men and machines rather than for kitchens and lunchrooms. Increase capacity of plant and output per man. Keep everybody happy and at the peak of energy, enthusiasm, efficiency. Do as the leaders are doing today in factories that are reaching new and higher production standards with the help of Ideal Rolling Cafeterias. Nourishing foods, refreshing beverages are served fresh, appetizingly —at their best—whenever and wherever they are wanted. Ask for booklet, "Human Beings At Work". It tells the thrilling story of the modern way to feed a factory.

THE SWARTZBAUGH MFG. CO., TOLEDO, OHIO

Distributed by

THE COLSON CORP., ELYRIA, OHIO

whatever is said about price in either of the laws.

In the Allis-Chalmers case, and in every other major defense strike, there has been no question of the management's willingness to assume and fulfill a defense contract. Can the government construe as unwillingness to produce for defense a management's inability to come to terms with labor? This still remains to be seen.

In the event of the Presidential declaration of an "unlimited emergency," in the event of war, or the imminence of war, all legalities, of course, would be of no avail.

●

Defense Economics Taught in College Course

Two inseparable topics, economics and defense, will be blended in a special college course, covering defense financing, wartime shipping, and mobilization of manpower and industry, to be offered to students of St. John's University, Brooklyn, in the coming fall semester.

The Very Rev. Dr. Edward J. Walsh, president of the university, has long been an advocate of all-out aid to Britain and a staunch supporter of preparedness. The new course is aimed not only to aid the study of current problems of defense, but the problems of post-war economic readjustment as well.

"These are problems which the college student of today must face in the future," Dr. Walsh said. "That history repeats itself is being demonstrated every day in the present conflict. These young men, as the industrialists, professional men, and leaders of the world of tomorrow, must be able to solve the problems that must be faced by the coming generation."

●

Canadian "Economy Cars" Seen as Output-Cut Result

The reduction in output of passenger automobiles, ordered by the Canadian government as a war measure, may result in production of an "economy car," lighter in weight and lower in cost than existing models.

Ottawa's restriction on motor vehicle production is based upon the foreign currency requirements of each model. The total foreign currency requirements of manufacturers have been reduced 20 percent by government edict. The unit production of cars need not necessarily be cut by that proportion, however, if the companies choose to produce smaller cars with standardized

How to Boost Wiring Capacity Without Rewiring

IMPROVE POWER-FACTOR WITH G-E PYRANOL CAPACITORS

Easy to install in out-of-the-way locations. Space-saving overhead racks could be used because Pyranol (the treating liquid in these capacitors) is noninflammable.

"With a total expenditure of less than $13,000, our savings have averaged $1,000 monthly, which is better than expected. In addition, we have had no maintenance expense." This is the profitable experience of the Murray Corporation of America, Detroit, after increasing the capacity of the plant distribution system with 1440 kva of G-E Pyranol capacitors.

You get—

1. A 10- to 40-per cent increase in circuit capacity (depending on plant power-factor)
2. Savings up to 50 per cent over other mtehods
3. Possible savings in power cost that may pay for the capacitors in one to three years

Does your plant use induction motors? Induction furnaces? Then the chances are that the power-factor is low—that your circuits are "clogged up" with a lot of reactive (nonworking) current. And that means that you can greatly increase the capacity of your existing wiring simply by installing G-E Pyranol capacitors on the lines. They neutralize reactive current and so permit the entire system to carry more *useful* current for additional motors and other equipment.

Equally important—if your power contract contains a power-factor-penalty or kva-demand clause, you will realize direct savings in reduced power cost that may *pay for the capacitors in from one to three years*. And the savings continue as a highly profitable return on the investment.

Ask your G-E representative for a quick estimate of the increase in capacity and the savings possible with Pyranol capacitors. Popular ratings are carried in stock for prompt delivery. We ship directly from the warehouse shelf.

Write for Bulletin GEA-77. General Electric, Schenectady, N. Y.

OTHER AIDS FOR OVER-LOADED SYSTEMS

AIR-COOLED INDUCTION REGULATORS

Over-loaded circuits mean low voltage and inefficient operation of motors and lamps. G-E air-cooled induction voltage regulators will bring performance back to standard. And indoor installations are easy to make—no vault is required. (Bulletin GES-2285)

PYRANOL TRANSFORMERS

An easy way to provide for new loads. Install them indoors at *load centers* to get power right where you want it. No vaults required. Close-to-the-load installations save secondary copper, give better voltage, and reduce losses. (Bulletin GEA-2048B)

AIR-COOLED TRANSFORMERS

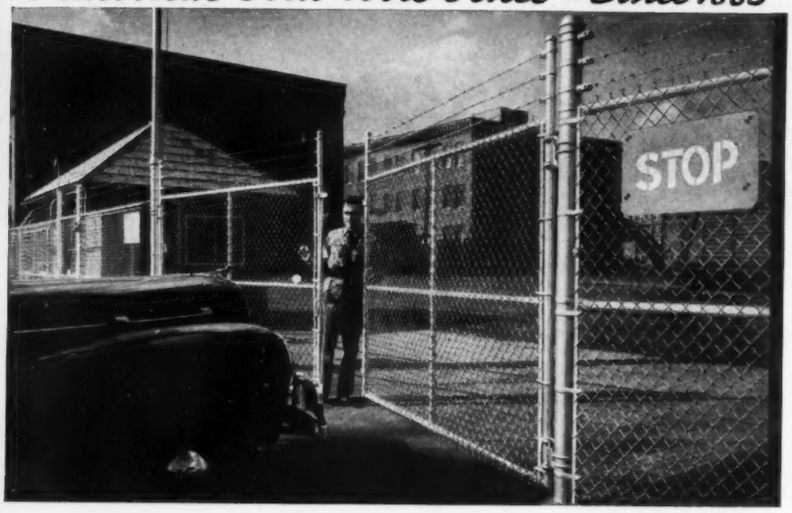
Like Pyranol transformers, these units can be installed indoors to obtain greater capacity plus savings in both time and materials. Particularly adapted to circuits 600 volts and below. (Bulletin GEA-897H)

GENERAL ELECTRIC

497-22-5700

PAGE FENCE

America's First Wire Fence — Since 1883

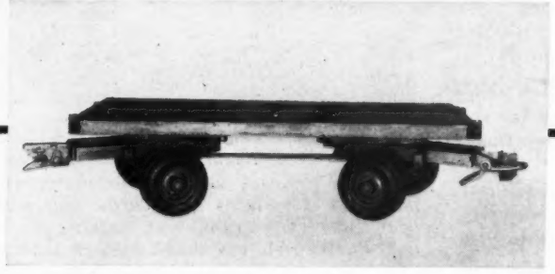


SERVICE AS LOCALIZED AS YOUR OWN POST OFFICE

★ The postal service in your town is based on training, responsibility and knowledge of local facts. So it is with Page Fence service. It is rendered by 102 local, responsible firms having factory training and long experience. You can rely on the Page Fence engineer because he knows local conditions. He will recommend the style of fence best suited to your needs and supply the stronger Page Winged Channel Posts. He will erect your fence to give you enduring and economical property protection. Write for "Fence Facts," to PAGE FENCE ASSOCIATION, Monessen, Pa., or Bridgeport, Conn., New York, Pittsburgh, Atlanta, Chicago, San Francisco.

A PRODUCT OF PAGE STEEL & WIRE DIVISION—AMERICAN CHAIN & CABLE COMPANY, INC.

Industry's **MAGIC CARPET**



To skim 5 Ton loads along, yet ride softly over all surfaces . . . you'll want something like this pneumatic-tired double steer tractor . . . It is so useful and capable for heavy yet fragile loads it has earned a reputation for almost magical ease.

Unusual feature . . . the 16"x4" dual pneumatic tired wheels with separate inner tubes . . . mounted on semi-elliptic leaf springs.

It's big . . . 96" long, 42" wide. Low-lying . . . 22½" from floor. Two stake pockets and automatic coupling at each end. Frame is continuous 3" channel with 4" bevel at corners. Dust-proof wheel bearings. Write for Service Trailer Bulletin.

SERVICE CASTER & TRUCK CO.

505 N. Brownswood Ave. Albion, Mich.

Eastern Factory: 434 Somerville Ave., Somerville (Boston), Mass.
Toronto, Canada: United Steel Corporation, Ltd., SC&T Co. Division

SERVICE
TRAILERS

color schemes, upholstery, finishes, and other common features.

"The foreign exchange content in a luxury car might be five times as great as that in a car of the low-priced popular class," said John H. Berry, Motor Vehicle Controller of the Canadian Department of Munitions and Supply.

The trend of economic policy in Canada frequently serves as a fore-runner of American action in the same field. While the United States does not share Canada's foreign exchange problem, the automotive industries of the two countries face in common the problem of conserving basic raw materials and keeping machines and tools free for the production of war goods. Already the American industry contemplates a 20 percent cut in passenger car production. The "economy car" is viewed in some quarters here as a possible means of meeting increased consumer demand for cars, despite restrictions.

•

Two Colleges Aid Plant on Engineer Training

The engineering problems of certain types of defense work, especially aeronautics, cannot always be met by engineers of general training, however excellent, without specific preparation.

With the aid of defense funds, the University of Maryland and Johns Hopkins University are giving qualified engineers quick training in the highly specialized phases of aircraft work to prepare them promptly for jobs involving electricity as applied to aviation, plastics, fluid mechanics and cabin supercharging, heating and ventilating, and aeronautical draftsmanship. The Glenn L. Martin Company of Baltimore, is co-sponsor of the plan and will find a ready use for graduates of the course.

Skilled workers from the Martin plant are also being prepared for jobs as inspectors.

•

Jones of N.A.M. Supports Ball Bill on Strikes

Thomas R. Jones, president of American Type Founders and chairman of the employment relations committee of the National Association of Manufactures, regards the Ball Bill (Senate 683, introduced by Senator Ball, R-Minn), as a good possible answer to the defense strike problem.

With certain qualifications, Jones reviewed the bill very favorably in his recent testimony before the Senate Committee on Education and Labor. The Ball plan provides a waiting period for strikes but does not forbid them. Jones made it plain that his NAM committee

IDLER DRIVES BEING REPLACED WITH LEATHER BELT-PIVOTED BASE DRIVES

Encouraged from various sources, many plants are replacing their idler drives with leather belt, pivoted motor base drives.

Particularly enthusiastic for this modern type of short-center drive are Graton & Knight customers. Not only is leather belting admittedly superior for pivoted base drives, but the special characteristics of Graton & Knight's Research Belting make it ideal for these drives.

Idler pulleys were formerly recommended to increase the belt wrap on drives with short centers and high pulley ratios. But the extra flexing around the idler pulley resulted in short belt life even when belts made of leather were used.

THE RIGHT COMBINATION FOR SHORT-CENTER DRIVES

As a result, other means of transmission were adopted for short-center drives, but at a sacrifice of well-known flat leather belt advantages. These are: high transmitting capacity, resilience, long life, and greater overload capacity.

The pivoted motor base — which automatically regulates belt tension — *does* make use of these advantages. Furthermore, in almost every case, total *initial* cost for pivoted base, pulleys and Research Belting is less. And *overall* cost is much lower.

Research Tannage Developed in G & K Laboratories

Because of Research Belting's built-in pulley grip, machine production is greater even when Research is run at relatively low tensions.

Belt life is longer because of this lower tension and because Research has greater pliability to withstand constant flexing over small pulleys.

Adjustments are fewer because Research is *lowest stretch* belting.

FREE BOOKLET

Graton & Knight will gladly send you a free copy of "The Right Combination," an informative booklet on short-center drives. Address Dept. B., Worcester, Mass.

(Advertisement)

for Pivoted Motor Bases
a pliable, true-running, low-stretch belt.
for Modern Group Drive
a pulley-gripping, low-stretch belt.
for Shifting or Step-Cone Pulleys
a firm, first-quality oak belt.
for Oil, Heat, Acid Fumes, etc.,
a special tannage.

THERE'S A RIGHT BELT FOR EVERY DRIVE... NOW YOU'LL FIND IT IN G & K's "FRONT LINE"

Graton & Knight offers a complete line of leather belting for complete range of transmission requirements. If you want increased machine output on continuously-operated production drives — pick Research. If you have shifting drives, flange or step-cone pulleys, Heart-Oak is the firm, first-quality belt to specify.

On pivoted motor base drives (small pulleys, constant flexing), you need a *pliable* low-stretch belt — that's Research.* And for severe atmospheric conditions — Spartan gets the call.

They are all Graton & Knight belts, manufactured in the same plant that does the tanning. From raw hide to finished belt — G & K craftsmen build in qualities essential to efficient transmission.

ALSO: Pryz-Oak (for light drives), Golden Chrome, flat link belting, and special belts for special machines.

Graton & Knight Belting turns more pulleys than any other make in the world!

*Write for new free bulletin, "The Right Combination for Short Center Drives."

GRATON & KNIGHT CO.

Tanneries and Manufacturing Plant at
WORCESTER, MASSACHUSETTS

GRATON AND KNIGHT

We are the only leather belting manufacturer with complete nationwide service facilities. See page in THOMAS' REGISTER.

GREATER OVERLOAD CAPACITY
MORE HOOK LIFT
HIGHER SPEEDS

Built in capacities of 1 ton to 20 tons—floor or cab control—Northern electric Hi-Lift Hoist offers many advantages on any type of monorail system. • Northern Hi-Lift Hoists have machine cut gears, roller bearings, welded steel frame—the characteristics of a sturdy, well built job. • Illustrated is a Northern Hi-Lift in a steel fabricating plant. Hard continuous service in this plant has proved the quality of the hoist. • Write for catalog.

NORTHERN HI-LIFT HOISTS

NORTHERN ENGINEERING WORKS, 2613 Atwater St., Detroit, Mich.

CRANES *Northern* HOISTS

POWER GRIP DRESSING FOR BELTS

To step up driving power of slipping belts just hold the stick Belt Dressing against the running belt. Fine for leather, rubber or composition belts. Just peel off the cardboard wrapper as the big 2" x 8" red-labelled bar is used. Does not contain Graphite.

Write for Booklet O-44

DIXON'S CUP & PRESSURE GUN GRAPHITED GREASES

Absolutely insoluble in water; hence perfect indoors or out. Graphite content makes each application last longer, lubricate better. Available in six consistencies, each fixed over a wide temperature range. At all better supply houses.

A LITTLE GRAPHITE DOES MUCH

PUT THESE TO WORK ON PIPE JOINTS

GRAPH-AIR GUNS

DRY GRAPHITE LUBRICATION FOR LOCKS AND A 1000 OTHER USES—SQUEEZE 'EM

DIXON'S L&P (Lubricating and Penetrating) GRAPHITED OIL

Instant-acting rust solvent, rust preventative and lubricant. Frees rust frozen joints, nuts, and other assemblies in a jiffy. Prevents alkaline and acid corrosion. Six container sizes.

GRAPHITE EXCELLENCE SINCE 1827

JOSEPH DIXON CRUCIBLE CO.
Jersey City, New Jersey

325

was opposed both to laws forbidding strikes and to compulsory—but not voluntary—arbitration.

The need for some means of reducing defense disputes was emphasized by Jones who quoted an NAM survey showing that from January 1 to April 25 nearly twice as many man-days' idleness were recorded as in all of 1940.

"Quantity defense production depends on continuous defense production," Jones pointed out. ". . . While we would not favor legislation to forbid strikes, we do believe that strikes should be resorted to only after peaceful method has been exhausted. . . . Accordingly we are fully in sympathy with legislation which will in some way postpone the exercise of the right of employers or employees to produce a stoppage of defense production while public authority has full opportunity to investigate the facts of the dispute and to attempt to bring about a settlement. Senate Bill 683 by Senator Ball, provides this opportunity for the public through duly constituted agencies to investigate the merits of industrial disputes which threaten to produce stoppages of defense production.

Written Notice Required

"Under this bill, employers and employees are required to give each other written notice of desired changes in employment conditions and to utilize the succeeding 10 days if necessary in an effort to reach an agreement without intervention of any outside agency. If no agreement is reached between the parties within 10 days after the giving of such notice, either party may then give notice to the Conciliation Service of the U. S. Department of Labor of an intention to strike or lockout, as the case may be, upon the expiration of an additional period of not less than ten days.

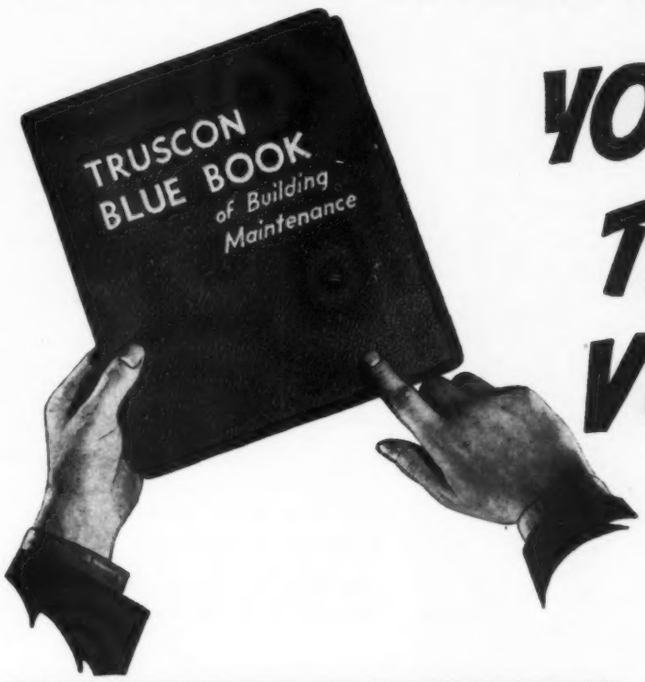
"The Conciliation Service is authorized under Section 5(d) to take such steps as may be deemed expedient for the purpose of bringing about a settlement of such dispute, including the giving of assistance in negotiating and drafting a settlement agreement.

"It is made the duty of both parties to honor summons from the Conciliator and to attend conferences during the 10-day period when this provision of the measure is in operation. It is made unlawful for the parties to strike or lockout, as the case may be, during this 10-day period, or to take any action during that 10 days 'to effectuate in any manner a strike or lockout.'

"The courts of the United States are given jurisdiction by Section 5(g) of the Bill to entertain applications by either party to the dispute to restrain the other from proceeding with a strike or lockout during this 10-day period.

"Under Section 6 of the Bill, when-

IF YOU ARE A BUILDING MAINTENANCE EXECUTIVE



YOU'LL FIND THIS BOOK VERY HANDY

It Simplifies YOUR BUILDING MAINTENANCE PROBLEMS

A few of the maintenance problems covered in the Truscon "Blue Book" of Building Maintenance:

HOW TO—

- **Harden cement floors.**
- **Rust-proof steel sash, tanks and structural work.**
- **Daylight old types of factory buildings.**
- **Patch holes in concrete floors.**
- **Slip-proof floors and landings.**
- **Dust-proof and oil-proof cement floors, stairs.**
- **Dust-proof and permanently color concrete floors.**
- **Remove mineral oil and grease from cement floors.**
- **Prevent paint peeling off of cement floors.**
- **Paint wet surfaces.**
- **Acid-proof steel work.**
- **Protect walls and floors against acid and alkali conditions.**
- **Protect and restore wood floors.**
- **Reduce sun glare.**
- **Damp-proof and beautify brick, concrete.**
- **Remove the "dark corner" problem.**
- **Waterproof new construction.**

These are only some of the many subjects covered in this remarkable book which is offered free to building maintenance executives.

WHATEVER your maintenance problem, this Truscon "Blue Book" of Building Maintenance will help you. It is a thorough and comprehensive reference guide on this subject. This book is illustrated with half-tones and working drawings. It contains a color chart covering paint for wood, steel, concrete—for floors, machines—acid and chemical resisting coatings, wall paints, etc. All information is fully yet concisely presented. This Truscon "Blue Book" of Building Maintenance is invaluable to any person who has anything whatever to do with building maintenance, inside or out. You should have a copy at once. It may save you worry, time and money.

TRADE MARK REGISTERED

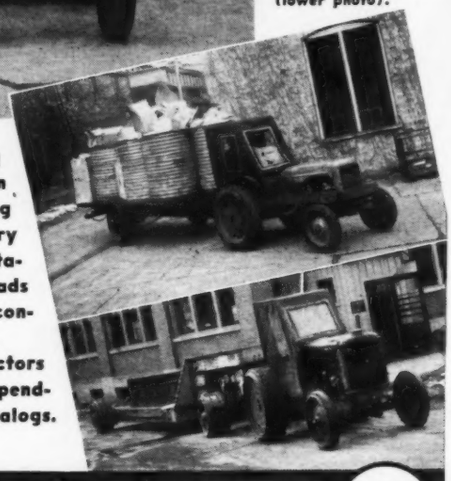
Offered free to plant maintenance executives.
Request *must* be written on business stationery.

TRUSCON LABORATORIES
DETROIT, MICHIGAN

FIVE TRACTORS

Two Model IB's (13.5 drawbar h. p.) keep shops going — haul castings, lumber and other materials from receiving room and machine shop to assembly floor and from foundry to machine shop (left). Also used for clean-up work—haul refuse for disposal (below).

Three Model IU's (31.8 drawbar h. p.) take on the heavy work—each hauls 22 ton loads with ease (lower photo).



This company has lowered its hauling costs—put intershop transporting on a sound, dependable basis—by using Allis-Chalmers wheel tractors. "Very dependable," says Supt. of Transportation. "They keep going. Haul big loads faster. I also like their small gas consumption and short turning ability". Investigate Allis-Chalmers wheel tractors —put your hauling on a low cost, dependable basis . . . NOW. Write for catalogs. See your Allis-Chalmers dealer.

ALLIS-CHALMERS POWER IT DOESN'T COST .. *it Pays!*

TRACTOR DIVISION—MILWAUKEE, U.S.A. TRACTORS, ENGINES, ROAD MACHINERY

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Maple Floors

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Workers' comfort goes hand-in-hand with efficiency. Smooth Hard Maple Flooring is a *comfortable* floor that's also long-wearing. It is warm and dry—prevents loss of body warmth through conduction—resilient, it holds off fatigue, thereby cutting down the accidents and mistakes that occur because workers are tired.

Because Hard Maple Flooring keeps efficiency up and keeps costs down, (it's easy to clean and to truck over, inexpensive to maintain, and remarkably long-wearing) it's being used today in even heaviest-duty plants.

Consider worker's comfort and efficiency next time you floor. Investigate **MFMA** Northern Hard Maple—in strips or blocks —Ask your architect.

MAPLE FLOORING MANUFACTURERS ASSOCIATION

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Floor *with* **MFMA** Maple

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(NORTHERN HARD)

ever the conciliator receives notice of an intended strike or lockout in an industry producing, constructing, or transporting any article critical to the national defense, and his efforts to conciliate such dispute appear to be making no progress, the conciliator shall notify the President, who may thereupon appoint a special mediation board to investigate and publish a report of its findings.

"Until the report of such board shall be published, providing the report is issued within 30 days of the board's appointment, either a strike or lockout in such industry shall be unlawful.

"Section 7 of the Act provides that the parties to a dispute may voluntarily request the conciliator to appoint a defense arbitration board with the decision and award of the board to be binding upon both parties. The defense arbitration board would be given power to require attendance of witnesses and the production of evidence and its requests in this connection would be supported by the federal courts."

•

April Strikes Cut Upcurve of Industrial Output

What the public long ago suspected is now established as a fact: namely, that strikes for a time put a definite crimp in the upcurve of industrial production. Curiously enough, however, this occurred in April after, rather than before, the peak of public indignation over strikes. When the dip did come, the coal strike was primarily to blame.

Reduced output in coal, automobiles, and steel was reflected by a drop in carloadings and electric power output. The last two fell to the lowest levels of 1941, though remaining substantially above the same period of 1940.

•

Survey Finds Defense Plants Working Longer Weeks

The five-day week of plant operation is fast vanishing in the defense industries.

Six-day and even seven-day schedules are becoming the rule, according to the National Industrial Conference Board, which has completed a survey of 193 metal-working companies employing from 250 to 5,000 workers. Of these, 153 plants were working all or part of Saturday and 55 were operating to some extent on Sundays. Only 35, or 18 percent of the companies surveyed, were still on the five-day week.

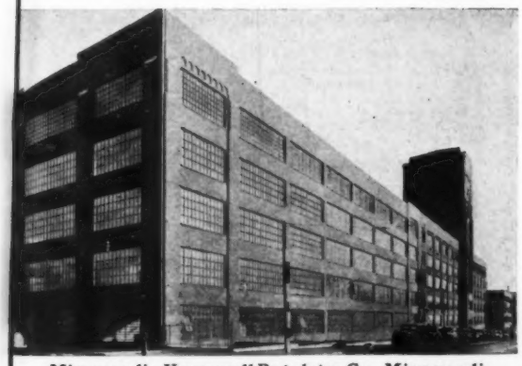
More than 50 percent of the companies were paying some overtime, but their policies varied greatly. One company was paying almost none—another was giving extra-hour pay to over 90

Daylighted interior, Kelsey-Hayes Wheel Co., Plymouth, Michigan. Giffels & Vallet, Inc., Architects; L. Rosetti, Associate; W. E. Wood Co., Contractors.

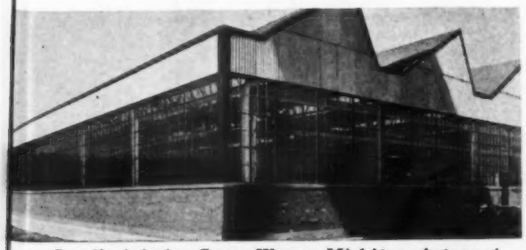
Fenestra's STEEL WINDOW SYSTEMS

HELPED COMPLETE THIS FINE DEFENSE PLANT IN 10 WEEKS

And Effected Very Large Savings in Cost



Minneapolis-Honeywell Regulator Co., Minneapolis, Minnesota. Edmund J. Prondzinski, Architect; C. F. Haglin & Sons Co., Inc., Contractors.



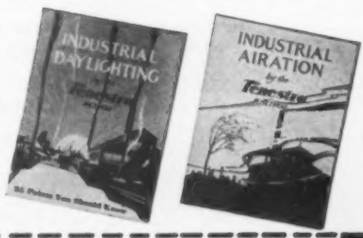
Bendix Aviation Corp., Wayne, Michigan. Argonaut Realty Division, General Motors Corp., Architects; Bryant & Detwiler Co., Contractors.

A farm 10 weeks ago. Today, the completed plant pictured above! This amazing record of speed in defense construction is due, in large part, to the fact that the building—like hundreds of others elsewhere—is chiefly roofed-in window-walls, built of prefabricated Fenestra Steel Windows, delivered already fitted, assembled, even prime-painted—COMPLETE!

Fenestra's Steel Window Systems are helping to speed construction, and to make defense plants highly efficient at the lowest possible cost. Based on engineering research, these systems assure a particular building of ample natural light and ventilation, *before it is erected.* And they effect important savings in the cost of the building, in the cost of equipment to supply light and air, in the cost of plant operation, in the cost of protection from air raids, and in the cost of post-emergency conversion to peace-time production. In quality, Fenestra products have met the exacting specifications of the U. S. Army and Navy for many years.

NO MORE GUESSWORK ON DAYLIGHT AND VENTILATION

In collaboration with the University of Michigan (department of Engineering Research), Fenestra Research Engineers have made many studies of the needs, the supply and the control of natural light and ventilation, in industrial buildings. Of special interest, now, are two booklets, "Industrial Daylighting" and "Industrial Airation." Free—no obligation; just mail coupon.



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percent of its workers. Causes of overtime were listed by the companies as lack of skilled labor, shortage of machine tools, and "insistence of employees on overtime work to swell their earnings."

No less than 62 of the plants in the survey admitted that multiple-shift operation was a new problem to them.

Real National Income Higher in 1940

Realized national income, by which is meant the total money payments received by individuals, mostly in the form of wages, salaries, professional fees, dividends, interest, rents, and royalties, amounted to approximately $72 billion in 1940, according to a preliminary estimate by The Conference Board. The 1940 total was 4.9 percent higher than the total for 1939, and was the greatest since 1930. The 1940 total was about $7.5 billion lower than the 1929 all-time high record of $79.5 billion.

If the total realized national income is adjusted for changes in the cost of living, the resulting real income in 1940 was the highest of any year on record. Using the year 1926 as a base period, and dividing the annual income totals by the cost-of-living index on that base, the real realized national income in 1940 amounted to $87.9 billion, as compared with $82.8 billion in 1929. On this basis, according to The Conference Board, total real national income in 1940 was from 3 to 4 percent higher than in any previous year.

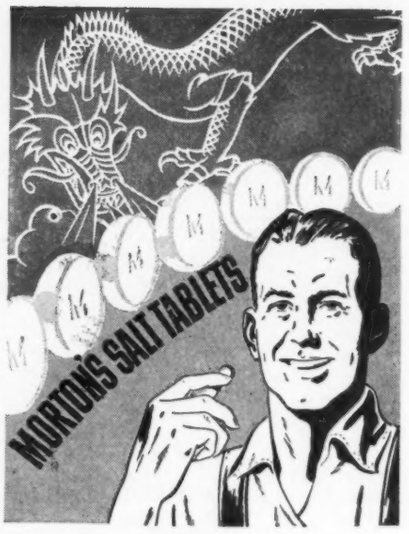
•

What Economic Effects If Germany Should Win?

If the present conflict in Europe should end with a victory for Germany and the Reich's known post-war economic program should be effectuated, the reaction on United States economy would be profound, trade specialists of the Department of Commerce believe.

In an analysis of Germany's program for post-war economy made by Louis Domeratzky of the department's Division of International Economy, and appearing in a recent issue of *Foreign Commerce Weekly*, it is pointed out that such a result would inevitably mean a drastic change in foreign trade conditions, with probably serious repercussions on our domestic economic status.

"Confronted by a political-economic combination on the Continent of Europe under the domination of Germany," the report declares that the individual American entrepreneur would hardly be strong enough to find a market for his product or service except on terms laid down by the National Socialist State. If the economic policy of Europe



Your Defense

Against the Stealthy Invasion of HEAT-FAG

The dangerous, insidious thing about salt loss is its silent, unseen undermining of efficiency. It affects the stamina and accuracy of ALL workers in hot weather — on hot jobs.

As workers sweat, salt is lost from their bodies. As the natural salt balance in the system is disturbed, there is a definite lowering of efficiency. Workers tire, make mistakes, feel out of sorts. And, production suffers.

That's Heat-Fag. It has long taken a terrific, almost unsuspected toll of American industry . . . yet the remedy is simple and inexpensive. Morton's salt tablets, in convenient dispensers at all drinking fountains, make it easy for workers to replace the salt lost by sweating.

AVOID HEAT-FAG USE MORTON'S SALT TABLETS

Place Morton Dispensers At All Drinking Fountains

Morton's modern dispensers deliver salt tablets, one at a time, quickly, cleanly, and without crushing or waste. Sanitary, easily filled — durable and dependable.

Morton's salt tablets contain the most highly refined salt, pressed into convenient tablet form, easy to take with a drink of water. They dissolve in less than 40 sec. after swallowing.

Order direct from this ad, or from your distributor.

DISPENSERS
500 Tablet size - - - - - $3.25
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TABLETS—Case of 9000
Salt Tablets - - - - $2.60
10 grain
Combination Salt-Dextrose
Tablets, per case - $3.15

FREE . . . write on your firm letterhead for a pocket size sample tube of MORTON'S SALT TABLETS, and new folder, "Heat-Fag and Salt Tablets."

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Smartly styled pedestal fans. 12 and 16-inch sizes. Ultra-quiet Micarta blades.

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Wall-mounted fans, also adjustable for desk use. 10, 12, 16-inch sizes. Ultra-quiet Micarta blades.

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Practical, long-life, desk bracket fans. Moderate in price. 12 and 16-inch sizes.

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MEDICAL AUTHORITIES SAY:

Moving air, even though barely perceptible, breaks up the "dead air blanket" that surrounds the body on hot, sultry days. It slightly lowers body temperature, deepens breathing — induces a refreshed, more vigorous feeling.

Reduce "heat fag" in your shop and offices this summer by providing cool, refreshing LIVELY AIR—air in motion. It will help prevent slowing down of vital production operations due to fatigue. It will help office employes keep "on their toes"—make costly mistakes less likely—increase employe satisfaction.

Why you need Westinghouse Fans to provide LIVELY AIR!

To provide LIVELY AIR for maximum comfort and efficiency, you need properly-placed fans with ample power to give *proper air circulation* at all times. You want *quiet, economical, trouble-free* operation for dependable cooling.

You need *Westinghouse Long-Life Fans*—recognized as the leader in quality fans for more than fifty years. Westinghouse offers a complete line of commercial fans suited to every need.

Phone your nearest Westinghouse Distributor, or write direct to Westinghouse Elec. & Mfg. Co., Dept. 1093, Mansfield, Ohio.

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MEMBER OF THE LEISURE LINE OF ELECTRICAL APPLIANCES

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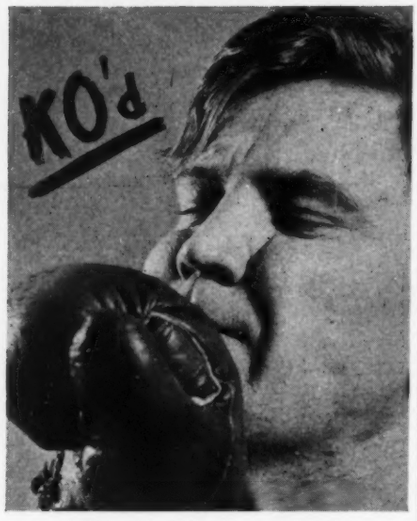

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THE "LONG-LIFE" COATING FOR FACTORY FLOORS & WALLS

Test INSL-X at our expense! See how this amazing rubber base coating stays put on floors and walls that "lick" ordinary paints. It's damp-proof, dust-proof, easy-to-clean, and *practically wear-proof*. INSL-X won't peel, soften, or become sticky on damp concrete floors—actually prevents moisture from coming through. No wonder America's leading plants are switching to INSL-X.

1. WATERPROOF. Originally developed for swimming pools. Actually guards against moisture coming through.
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Some Territories Still Available for Manufacturer's Representatives

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Please send free samples of:
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were to be based primarily on self-sufficiency, and the needs of the individual consumer subordinated to the fundamental policies of the State, the mere fact that an American product or service might be superior would not be a sufficient basis for successful export trade.

"If the plans of the Reich should materialize, Germany would probably appear in the world markets as a willing buyer for the whole Continent on certain terms, which would undoubtedly include some form of open or disguised barter. Some time ago certain German economic spokesmen suggested that some of the raw-material and foodstuff producing countries might be asked to extend credit, in view of the time lag between the delivery of raw materials and the production of the finished products would be used as means of payment."

It is also to be assumed, the report states, that if German plans should be put into effect, a similar appeal would be made to the United States on the basis of the European need for our cotton, corn, lard, feedings stuffs, metals, and perhaps petroleum products, and other raw materials and foodstuffs which Europe used to take from us before the war. The basis, under such circumstances, it is pointed out, "would probably be a combination of credit and some form of barter, but the trade would be strictly controlled on the European side, and might, therefore, necessitate corresponding controls on the part of the United States."

Referring to the effect of German plans on our internal economy, Mr Domeratzky declares that it is safe to predict that, if consummated, "they would bring about an acceleration in the tempo of economic change in this country and might force us into a policy of self-sufficiency, involving, temporarily at least, a lowering of our living standards. A German success would undoubtedly necessitate more fundamental changes in our agricultural production on a more or less permanent basis. It would lower the efficiency of some of our manufacturing industries by curtailing the prospects of exports and thereby reducing the rate of utilization of plant capacity. If such an eventuality should also restrict United States access to foreign raw materials sufficiently to justify our resorting to artificial substitutes, it would mean a higher raw-material cost for our industries, as well as reduced purchasing power and, therefore, a poorer market for our products in the raw-material producing countries. And, finally, if we should be compelled to adopt economic self-sufficiency as a national policy, it would involve a degree of economic planning that might seriously affect some of our fundamental political institutions."

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● **When you are giving a machine the tough jobs to do — you need plenty of power Plus a shaft that stands hour after hour of continuous production without let-up. Stow gives you this combination of reliability plus power — backed up by 66 years' experience as the originators of the flexible shaft.**

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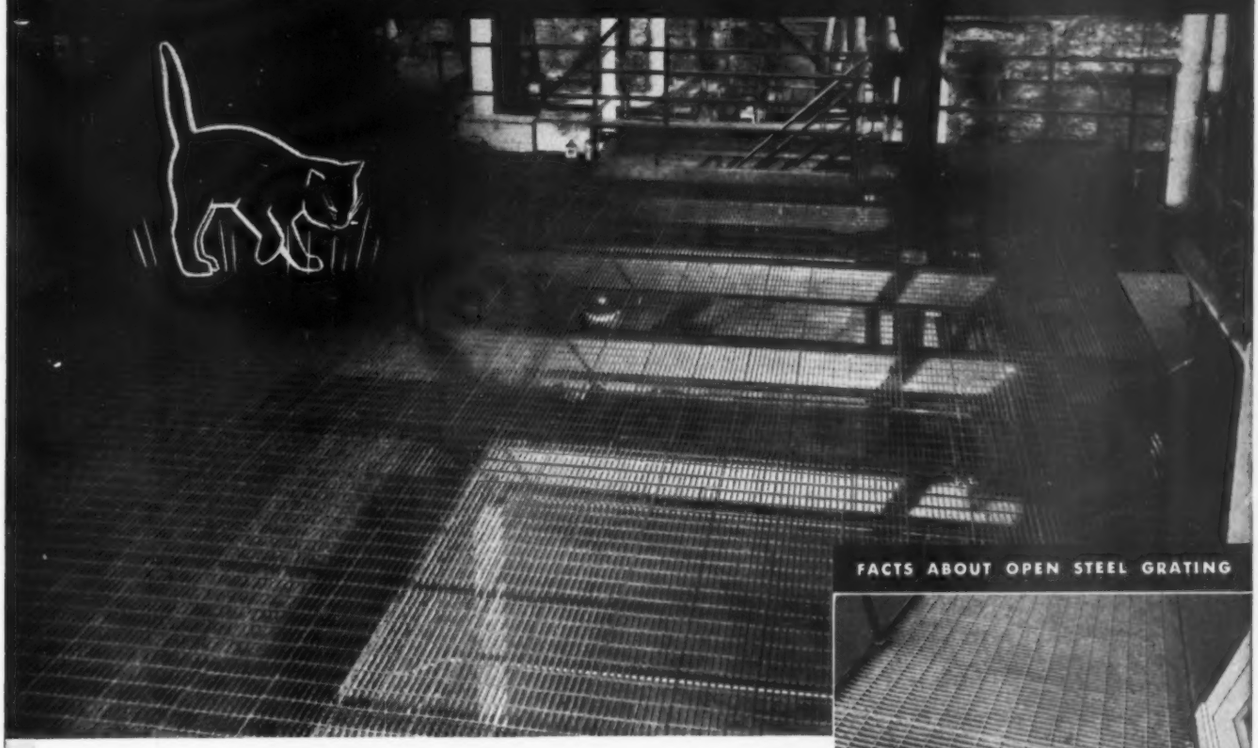
Established 1875 *Inventors of Flexible Shafts*

THESE FLOORS ALSO SERVE AS VENTILATORS



FACTS ABOUT OPEN STEEL GRATING

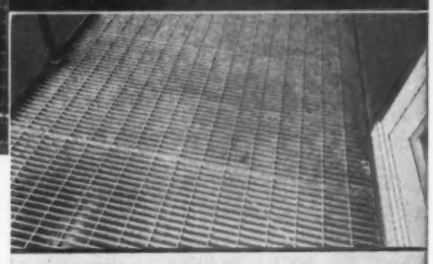
FLOORS of Open Steel Grating are factory-fabricated from a combination of structural members rigidly connected by interlocking, welding or riveting. And because of their open construction, they provide a free circulation of air—over, under, around and *through* their surface.

Because they are open in construction, Open Steel Grating floors and steps do not accumulate dirt, dust, grease, oil or moisture on their bar edges. Used for outside walks, they do not collect snow, ice or water. They are virtually "self-cleaning."

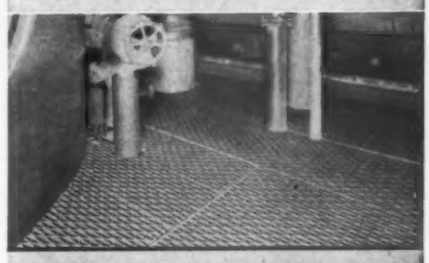
Floors of Open Steel Grating are non-slip—safe—do not wear smooth. Their non-slip surface remains as long as the floor itself. For more information on this durable, fireproof, rigid type of floor that is factory-fabricated to *your* individual requirements and can be quickly and easily installed, write today for the free booklet shown below.

This seal is your assurance OPEN STEEL FLOORING INSTITUTE INC. *of a quality product*

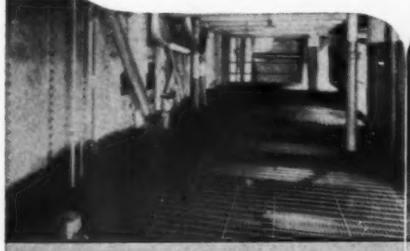
OPEN STEEL FLOORING INSTITUTE, INC.



SELF-CLEANING. Open Steel Gratings do not accumulate dust, dirt, grease, oil or moisture. Their construction makes them virtually self-cleaning.



ECONOMICALLY INSTALLED. Every section of Open Steel Grating is built to the requirements of the individual job. This factory layout insures speedy installation and perfect fit.



NON-SLIP SAFETY. Open Steel Gratings cannot accumulate skid-inducing substances —provides an even, non-slipping, stumble-proof surface.

LIGHT WEIGHT. Every pound of material is used, with maximum efficiency to carry or distribute loads—meaning less dead weight, lighter supports, reduced erection costs.

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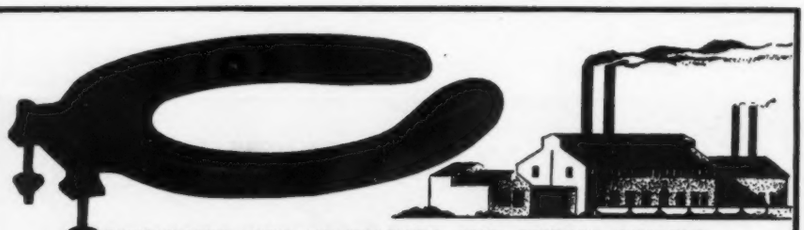

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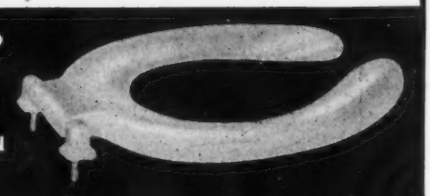
Specify STASCO EBONITE—concave-type, one-piece, seamless vulcanized hard-rubber seat that sets a high standard of *quality* for a *low-priced, completely sanitary* seat for factories and public toilets. This seat lasts indefinitely, won't wear out and is *guaranteed to withstand rough usage.*

Available in open or closed front with or without cover for regular bowl, and open front less cover for elongated bowl.

WRITE FOR ... the new Stasco buyer's guide. It describes and illustrates the correct toilet seat for every purpose.

NOW ALSO COVERED IN WHITE PYROXYLIN FINISH



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In the Test Laboratory *we prove the qualities* that ALLENS demonstrate in your shop

ALLEN "sales-points" are established in the laboratory. They're read on the dials of testing machines that never exaggerate, never pass defective screws. We mean to be sure that any flaws will show up here: *not in your operating machines!*

Each lot of ALLENS, each heat of screws is put through the most critical tests that hollow screw specialists can devise and highly specialized test apparatus can impose. No hollow screws are so mercilessly tested—for tensile strength, for yield point, elongation, reduction of area, Izod impact and Rockwell hardness. Thread accuracy is confined to precision limits by microscopic examinations under the *Comparator*, a testing device which detects even the most minute deviation in thread lead.

Screws are constantly gauged for dimensional accuracy and concentricity during the process of manufacture. Finally every "ALLEN" must undergo a visual check-up at the hands of keen-eyed specialists who are quick to reject any screw that is even slightly sub-standard.

Allen has published, for many years, dependable test data on the salient properties of its products. These data accurately evaluate the physical characteristics of the screws, giving valuable guidance in plant or product engineering. You should have them handy!—ask your Distributor.

THE ALLEN MANUFACTURING COMPANY
HARTFORD, CONNECTICUT, U.S.A.

Delivers The Goods Automatically

(*Continued from page* 54)

tem fits into our production requirements by providing a smooth, uniform rate of flow of raw materials in increments sufficiently small to permit economical runs on machine tools and other equipment without accumulating excess materials. Scrap and waste are disposed of immediately, and finished parts are promptly transported to assembly sections. Completed motors are delivered to the shipping department packed and ready for shipment 20 minutes after passing final inspection.

The entire transportation system described here is fully automatic after the destination has been selected. The service is available at all times, eliminating all the loss of waiting time formerly involved. The entire operation involves delivery overhead, out of the way of work, without being touched by hand. Lifting, bending, switching, and operating handling devices by warehouse operators are thereby reduced to a minimum.

Orderly Warehousing

Good housekeeping is fostered. Rapid, orderly, and dependable deliveries of material are made in quantities sufficiently small to permit reducing the inventory, because time is not lost accumulating larger quantities before moving to the succeeding operation. Scrap, waste, refuse, and empty tote boxes are quickly disposed of, and all material is in containers that lend themselves to economical and orderly warehousing.

So successful has the installation been that we find ourselves increasingly inclined to lean in the direction of planning our production department layout to fit our handling system, rather than deny any production operation the benefit of this economical, efficient transportation. And when we are stumped by a layout problem and are forced to set up a department so that a loading station is needed at a point not covered by an existing station, we cheerfully make the necessary alteration in the conveyor system.

Experience shows that it costs up to $300 to move a station. Often we can use a special type of vertical elevator station, which may be used to move the tote box also in the horizontal plane if it comes from a machine at a point that is off the conveyor line, and thus save the cost of building a new station. But thus far, whatever the cost of tailoring the conveying system and the production lines to make a perfect fit, it has been worth every cent of it.